OHIO DEPARTMENT OF TRANSPORTATION

LAK-090-02.93 SLOPE REPAIR

LANDSLIDE EXPLORATION REPORT

OCTOBER 31, 2024

FINAL

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LANDSLIDE EXPLORATION REPORT

OHIO DEPARTMENT OF TRANSPORTATION
PID: 112663

FINAL

PROJECT NO.: 30902165
DATE: OCTOBER 2024

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October 31, 2024

FINAL

Kyle J. Dohlen, PE
OHIO DEPARTMENT OF TRANSPORTATION
District 12 Engineering Office
5500 Transportation Boulevard
Garfield Heights, Ohio 44125

Subject: LAK-90-02.39 Landslide Exploration Report
Client ref.: PID 112663

Dear Mr. Dohlen,

We are pleased to submit the Landslide Exploration Report for the LAK-90-02.93 project. The attached report is intended to provide subsurface findings and geotechnical recommendations based on the geotechnical data collected for the project.

WSP USA appreciates the opportunity to provide the attached Landslide Exploration report. If you have any questions, feel free to contact us directly via phone or email.

Yours sincerely,

Hamzeh Saqer, PE
Geotechnical Engineer

Michael M. Flanagan, PE
Geotechnical & Tunneling Midwest District Director

HS/MMF

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1 EXECUTIVE SUMMARY

WSP USA Inc. (WSP) was retained by Ohio Department of Transportation (ODOT) to perform geotechnical engineering and project development services for multiple slope repairs in ODOT District 12. The objective of this report is to present descriptions and interpretation of existing subsurface conditions, evaluate the cause of slope failure, and recommend suitable repair solutions to remediate the failed slopes along the existing roadways. The scope of the project includes three sites, referred to as LAK-90-02.93, LAK-90-12.39, and GEA-322-05.76. This report covers the LAK-90-02.93 site, the remaining sites are submitted under separate covers.

WSP provided the following services:

- Review of existing available subsurface site data, including historical borings and site history, to determine the required geotechnical subsurface exploration for repair design and construction considerations.
- Solicitation, management, and coordination with surveying and geotechnical drilling subcontractors for the test borings and geotechnical laboratory testing.
- Review, quality control, and interpretation of the geotechnical data report.
- Development of subsurface profiles based on the geotechnical data report.
- Geotechnical analyses relating to slope stability for existing site conditions.
- Geotechnical input and recommendations for slope repair alternatives.
- Preparation of this geotechnical report and supporting documentation.

The work performed generally conforms to the current versions of the American Association of State Highway and Transportation Officials (AASHTO), ODOT Specifications for Geotechnical Explorations (SGE), and ODOT Geotechnical Design Manual (GDM). This geotechnical report summarizes the conditions encountered during the subsurface exploration program and presents geotechnical evaluations and recommendations for the proposed remediation alternatives. All elevations reported are in reference to feet above Mean Sea Level (MSL).

1.1 EXPLORATION AND FINDINGS

Landslide exploration was performed at the project site between December 1st, 2022, and July 19th, 2023. S&ME Inc. of Ohio was hired as the drilling sub-contractor to perform the exploration and laboratory testing, and NEAS Inc. was sub-contracted to perform the survey of the site. A total of ten (10) landslide borings, five (5) hand-sampled borings, and five (5) Dynamic Cone Penetration (DCP) soundings were drilled at the locations indicated on the boring location plan provided in Appendix A.

Two of the borings were located on the shoulder of existing roadway, Interstate Route 90 (IR-90), identified as B-002-0-22 and B-008-0-22. Asphalt pavement was encountered at the ground surface in these borings, underlain by a layer of granular base with varying thickness. Topsoil was encountered in the other borings performed within the limits of the slope. Underlying the surficial materials, embankment fill was encountered in nine (9) of the borings, consisting mainly of Silt and Clay, and Silty Clay identified as ODOT classes A-6a and A-6b, respectively. A few thin layers of granular fill were also encountered consisting of Gravel with Sand, Silt and Clay (ODOT A-2-6). It is also noted that several recovered fill samples contained traces of wood fibers, coal fragments, and roots.

Underlying the surficial materials and fill, natural soils were encountered, consisting mainly of Clay, Silt and Clay, and Silty Clay (ODOT A-7-6, A-6b, A-6a). In addition, a few thin deposits of granular materials were also observed and classified as Sand, Gravel, Gravel with Sand, and Gravel with Sand and Silt (ODOT A-3a, A-1-a, A-1-b, A-2-4). The natural soils were encountered at the ground surface as observed during hand sampling and as deep as 53 feet at boring B-008-0-22. Bedrock was encountered in all borings, at depths ranging from 2.5 to 77 feet. Bedrock consisted of Shale with varying degrees of weathering and a few zones of Claystone.

A laboratory testing program was conducted to verify the field classification of soil and rock and to estimate the engineering properties for use in the analysis. In addition, field instrumentation was also performed including installing one inclinometer casing at B-001-1-22 and two groundwater observation wells installed at B-001-1-22 and B-005-0-22.

After the landslide borings were completed, additional borings were deemed necessary to aid in the design of drilled shaft retaining wall to stabilize the existing slope. Five (5) additional retaining wall borings (B-005-1-23, B-007-3-23, B-007-4-23, B-008-4-23, and B-009-1-23) were performed by S&ME Inc. of Ohio between May 13th and May 24th, 2024, at mid-slope locations by means of benching with a bulldozer. These borings confirmed the findings of the preliminary investigation and provided more information about bedrock and groundwater conditions. Further testing of soil and rock was conducted to determine the engineering properties for use in the design of the proposed drilled shaft retaining wall. In addition, a groundwater monitoring well was installed at boring B-009-1-23.

1.2 ANALYSIS AND RECOMMENDATIONS

Slope stability analyses were performed for the site based on existing site information using SLOPE/W (GeoStudio 2021.4) software package. Subsurface conditions were developed using the borings and laboratory testing performed as a part of this report and using historical borings. Cross sections of the site were obtained based on survey information performed by NEAS Inc. and used to develop the geometry for the analysis. Short term (undrained) and long term (drained) limit equilibrium analyses were performed using the Morgenstern-Price method. An overall factor of safety against sliding less than 1.3 was deemed unacceptable according to ODOT Geotechnical Design Manual (GDM), dated July 2024.

Multiple alternatives were considered to repair the failed slopes. However, based on the results of the slope stability analysis and the feasibility of each alternative, the following recommendations were developed to repair the current slope failures. Stationing reported herein is referenced from project plans developed by WSP.

— **STA 20+10 to 21+30:**

The recommended slope repair for this section of the slope is reinforcing the slope using soil nails. This alternative would require excavating the failed soil at a slope of 1H:1V then installing soil nails at 3-foot spacing and an inclination angle of 10 degrees, then installing shotcrete at the face of the excavation. Excavated on-site soil (Type A-6a) can be used to establish a temporary access road as shown on the proposed plans. This approach yielded a factor of safety of about 1.3 as shown in Appendix B.

— **STA 29+90 to 31+55:**

At this location of the site, drilled shafts with plug piles are recommended as a retaining wall. Our design included 3.5-foot diameter shafts spaced at 5.25 feet to be installed to a depth of 15 feet below top of competent bedrock as shown on the project plans. The drilled shafts should be reinforced using steel rebar cages. Between the drilled shafts, 3.0-foot diameter plug piles are recommended to be installed to top of rock consisting of plain concrete as shown on the project plans. This approach yielded a minimum factor of safety of about 1.6 as shown in Appendix B.

2 INTRODUCTION

2.1 PROJECT LOCATION

LAK-90-02.93 site (the site) is located within the limits of Willoughby Hills city, Lake County, Ohio. The site is adjacent to Interstate Route 90 (IR-90) westbound, just northeast of the interchange with Interstate I-271 and west of State Route 91 (SR-91). The site extends approximately from Station 92+00 to 118+00, extending approximately 2600 feet. Note that our Stage 1 plans show both IR-90 stationing and local project stationing that ranges between stations 10+00 to 36+00. Deer creek is located adjacent to the site and runs parallel to IR-90. Site location map is shown in Figure 1.

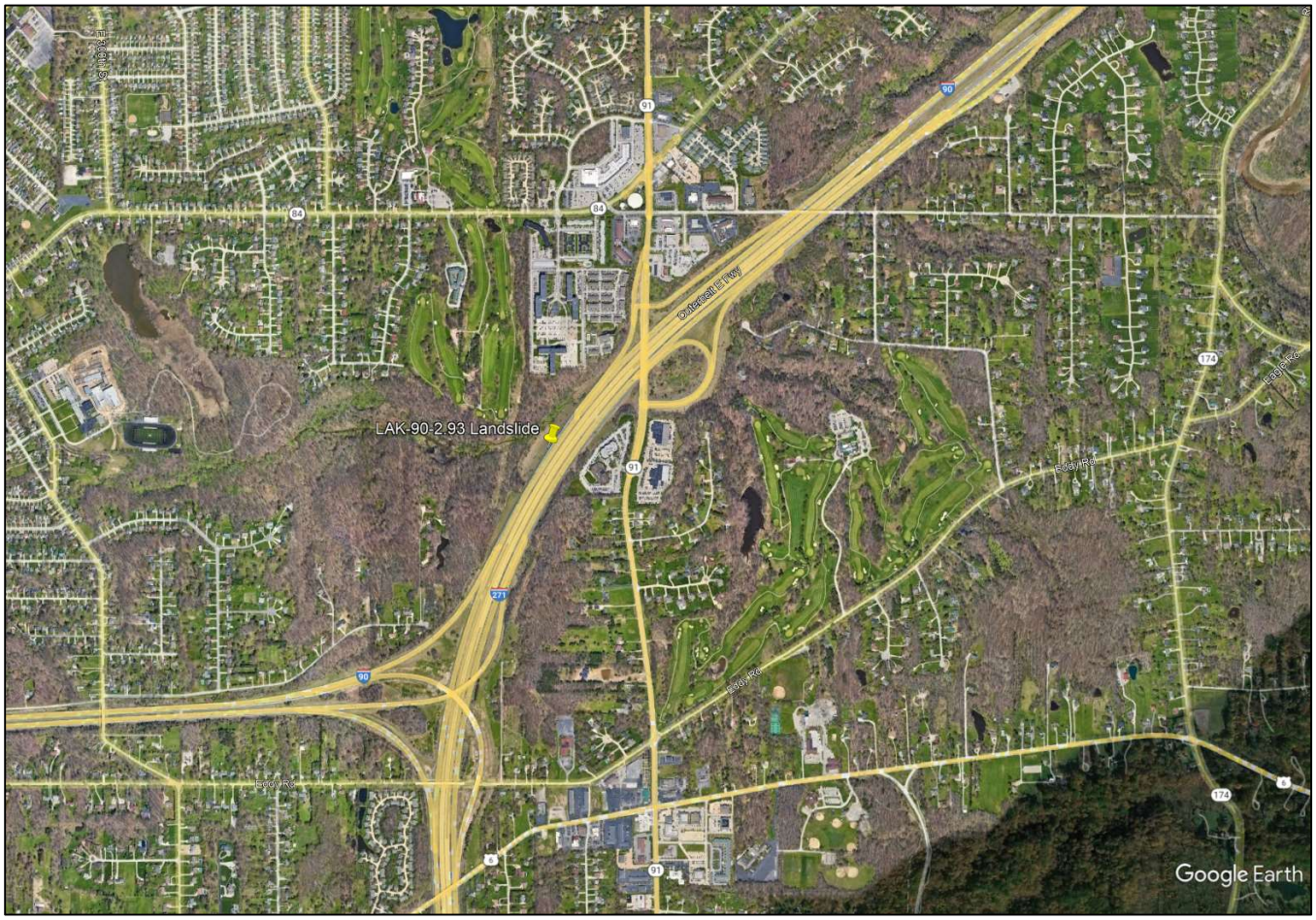

Figure 1: Site Location Map

2.2 PURPOSE

The purpose of this report is to identify the source of slope failure and provide slope repair alternatives and design recommendations to control any further damage to the existing roadway. This report investigates the underlying cause of slope failure including landslide and the effects of erosion on the slope stability.

2.3 HISTORIC RECORDS

Historic geotechnical records were reviewed for the existing roadway alignment and were obtained from ODOT's transportation information mapping system (TIMS). Based on plan reviews, a steep shale drainage channel was present on site prior to the construction of interstate route (IR-90). A geotechnical report for Project 721-60 (CUY-1-15.91/LAK-1-0.00) dated November 16, 1961, indicated that a previous slide failure was encountered approximately from station 103+00 to 106+00 during embankment construction. A tension crack was observed parallel to the southbound centerline and associated subsidence appeared at the surface of the embankment. In addition, it was reported that a roll near the toe was formed at the ground surface showing lateral displacement of embankment foundation and heaving at the toe of the embankment approximately from station 102+25 to 107+25.

The subsurface exploration program for the embankment failure consisted of drilling geotechnical test borings located approximately from station 101+50 to 108+00. The findings of the exploration indicated that failure of the embankment was considered a rotational landslide failure and was associated with overstressing of the embankment foundation soils, as reported in the 1961 report. As a result of the exploration, a berm was established at the toe of the embankment extending from station 102+00 to station 109+00, with an estimated height of 20 feet and 40 feet in width with a slope of 2H:1V.

2.4 EXISTING CONDITIONS

This section provides a general description of existing conditions and topography of the site. Elevations are referenced from the survey performed by NEAS Inc. dated January 6, 2023, and existing conditions reported herein are based on site history and observations made during multiple site visits by WSP during the subsurface exploration. Existing site conditions are shown in Figures 2 through 4.

As noted in historic records summary above, a steep shale drainage channel was present on site prior to the construction of Interstate Route 90 (IR-90) at the site. Currently, the northeast portion to the north of the westbound lanes of IR-90 is a steep hummocky embankment. Existing grade elevations at the toe of the slope range from about elevation 686 to about 788 feet. The elevation of existing roadway along the shoulder of IR-90 varies from about 743 feet to about 792 feet. Newly planted trees were observed at the site. No underground utilities were identified in the survey. In terms of existing drainage conditions, the following observations were made:

- Multiple culverts with headwalls out letting to the site from south and the west directions, which then flow into a 120-inch diameter culvert that carries all the water from the site away to the northeast direction.
- Deer Creek stream flows through site parallel with IR-90 and flows downstream into the 120-inch culvert. The stream comes from the northwest direction.
- There is also a concrete gutter from the north that carries water to the site to flow into to the 120-inch culvert.

Surficial to moderate depth slides were observed at two main locations on the site. Several scarps were observed around station 102+00 and significant erosion was observed near the toe creating slope instability. It is our understanding that poor drainage conditions within the embankment and erosion near the toe are the main reasons of the slide. No signs of damage in the roadway were observed at the time of this report.

Figure 2: General View of the Site (Looking Northeast)

Figure 3: Existing Conditions at the Toe (Looking Northeast)

Figure 4: Existing Conditions at the Toe (Looking Southwest)

3 REGIONAL GEOLOGY

This section provides an overview of regional site geology for the site. Information about surficial soils is based on review of the soil survey published by United States Department of Agriculture (USDA), Soil Conservation in 1974. The current version of the soil survey for Lake County is available online (Version 20, dated September 9, 2022) and provides a context for general soil and engineering properties of representative near surface soils. Bedrock information presented herein are referenced from publicly available geological survey obtained from Ohio Department of Natural Resources (ODNR) website.

3.1 SURFICIAL SOILS

A soil resource report was generated for the specific area of interest (AOI) at the project site using USDA Natural Resources Conservation Service (NRCS) as shown in Figure 5. Note that the AOI is referenced for general soil information and is not intended to replace site specific geotechnical information data.

Native surficial soils beneath the site are predominantly lake deposited Pleistocene-age lacustrine Tills. The site's surficial soils generally consist of an unsorted mix of silt, clay, sand, and gravel, with variable carbonate content and are gray to light brown when un-weathered. The mapped soil at the site consists mainly of:

- Udorthents (UdD): Fill, moderately steep with a slope of 12 to 18 percent.
- Gasport Silty Clay Loam (GoF): Hills, generally well drained, with a thickness of 20 to 40 inches to paralytic bedrock, sloping 25 to 70 percent.
- Orrville Silt Loam (Or): Flood plains, somewhat poorly drained, with a thickness of over 80 inches and relatively flat with a slope of 0 to 2 percent.

Figure 5: Soil Survey Map (NRCS)

The engineering properties of surficial soils were also obtained from the 1974 soil survey to estimate the range of typical engineering properties of the soils likely to be encountered at the site. The engineering properties are summarized in Table 1 below. Actual subsurface conditions at the site may vary from these generalized properties.

Table 1: Soil Engineering Properties from NRCS Soil Survey

SOIL	DEPTH (IN.)	SOIL CLASSIFICATION		PERCENTAGE			SOIL PLASTICITY	
		USCS	AASHTO	#10	#40	#200	LL	PI
Gasport Silty Clay Loam	0-2	CL	A-6	85-100	80-95	70-90	24-40	6-15
	2-27	CL, CH	A-7	65-95	65-90	60-85	40-60	15-34
	27-32	CH, CL	A-7	55-90	55-85	50-80	40-55	18-30
	32-36	Weathered Rock						
Orrville Silt Loam	0-7	CL, CL-ML, ML	A-4	95-100	90-100	65-80	22-35	4-10
	7-28	CL, CL-ML, ML	A-4, A-6	60-100	55-95	50-90	20-40	2-16
	28-62	CL, ML, SC, SM	A-4	60-100	45-85	35-75	15-35	NP-10

3.2 BEDROCK GEOLOGY

Based on Bedrock Geology and Topography maps obtained from Ohio Department of Natural Resources (ODNR), mapped bedrock (Doh) underlying glacial deposits at the site consists of brownish black to greenish gray Devonian-aged Ohio Shale, that has a marine or marginal marine origin. Ohio Shale is a carbonaceous sedimentary rock with carbonate or siderite concretions and layer thickness varying from 250 to 500+ feet. The formation contains laminated to thinly bedded shale. Historic borings indicate that top of rock varies from elevation 695 to 927 within the limits of the site.

Figure 6: Bedrock Geology and Topography Map (ODNR)

4 SUBSURFACE EXPLORATION

A subsurface exploration program was developed in coordination with the drilling subcontractor and ODOT District 12 Engineering Office. The subsurface exploration program consisted of performing geotechnical test borings, Dynamic Cone Penetrometer (DCP) Soundings, and hand-sampled borings as described below.

4.1 SOIL BORING PROGRAM

A total of ten (10) landslide borings, five (5) DCP soundings, and five (5) hand-sampled borings were advanced by the drilling subcontractor, S&ME, Inc. of Ohio (S&ME), between December 1st, 2022, and July 19th, 2023. Field coordination as part-time field oversight of the field exploration was performed by a WSP geotechnical engineer. A geotechnical data report was prepared by S&ME dated June 28, 2024, and is included in Appendix A. The field exploration work was conducted in general accordance with the standards of the American Society for Testing and Materials (ASTM) and ODOT Specifications for Geotechnical Explorations (SGE), dated July 2022. A boring location plan is included in Appendix A.

Soil borings were performed using a track-mounted drill rig. Boreholes were advanced using 3.25-inch inside diameter hollow stem augers. Table 2 presents a summary of boring information, and individual boring logs are included in Appendix A. Soil sampling consisted of Standard Penetration Test (SPT) sampling in accordance with AASHTO T206. SPT sampling was conducted by driving a 2.0-inch outside diameter split spoon sampler 18-inches using an automatic hammer. Sampling was performed continuously until boring termination depth is reached or refusal was encountered. Pocket penetrometer measurements were obtained for all cohesive soil samples and three undisturbed samples (thin-walled Shelby tubes) were collected from soft cohesive materials and were used for testing.

After the landslide test borings were completed, five (5) additional retaining wall borings (B-005-1-23, B-007-3-23, B-007-4-23, B-008-4-23, and B-009-1-23) were performed between May 13th and May 24th, 2024, at mid-slope locations by means of benching with a bulldozer. All the additional borings extended about 20 feet into bedrock. Bedrock coring was performed at borings B-001-0-22, B-001-1-22, B-002-0-22, B-005-1-23, B-007-3-23, B-007-4-23, B-008-4-23, and B-009-1-23 using an NQ2 diamond core bit. An approximately 2-inch in diameter rock cores were obtained. Rock classification and Rock Quality Designation (RQD) values were determined in the field and shown on the boring logs. Rock core samples were documented with photographs that are provided in Appendix A.

Figure 7: Site Photograph Taken During Drilling

Table 2: Summary of Borings

BORING ID	BORING TYPE	GROUND ELEVATION (FT)	BORING DEPTH (FT)	STATION	OFFSET	LATITUDE	LONGITUDE
B-001-0-22	C5	763.2	24.2	101+91.26	168.40'LT.	41.5976722	-81.4444256
B-001-1-22	C5	746.8	25.1	102+38.63	190.46' LT.	41.5978175	-81.4444043
B-001-2-22	C5	727.2	28.0	102+63.57	256.28' LT.	41.5979709	-81.4445622
B-002-0-22	C5	770.1	77.0	103+56.65	135.95' LT.	41.5980221	-81.4440048
B-003-0-22	C5	717.3	32.5	104+76.91	279.99' LT.	41.5985198	-81.4442091
B-004-0-22	C5	710.1	36.8	106+75.82	303.11' LT.	41.5990276	-81.4438634
H-004-1-22	C5	687.4	6.0	107+42.17	373.89' LT.	41.5992943	-81.4439336
B-005-0-22	C5	707.8	34.9	108+48.13	273.76' LT.	41.5993843	-81.4434019
B-005-1-23	E3	707.2	64.4	108+15.02	277.46' LT.	41.5993969	-81.4434065
H-006-0-22	C5	686.0	6.0	108+89.16	335.55' LT.	41.5995783	-81.4434945
B-007-0-22	C5	709.2	36.0	110+36.39	253.81' LT.	41.5997833	-81.4429225
D-007-1-22	C5	693.0	7.2	110+15.95	282.06' LT.	41.5997833	-81.4430515
H-007-2-22	C5	685.3	6.0	110+24.06	322.51'LT.	41.5998683	-81.4431515
B-007-3-23	E3	716.4	65.9	110+08.15	234.43' LT.	41.5996874	-81.4429296
B-007-4-23	E3	721.0	69.2	111+20.17	223.23' LT.	41.5999213	-81.4426424
B-008-0-22	C5	753.0	77.4	112+56.66	151.41' LT.	41.6001021	-81.4421206
B-008-1-22	C5	718.3	47.7	112+45.28	230.54' LT.	41.6002123	-81.4423735
D-008-2-22	C5	700.1	15.1	112+20.26	259.64' LT.	41.6002063	-81.4425155
H-008-3-22	C5	683.3	4.5	112+00.89	293.97' LT.	41.6002213	-81.4426595
B-008-4-23	E3	724.4	72.0	112+24.04	215.90' LT.	41.6001403	-81.4423811
D-009-0-22	C5	701.1	12.1	112+66.18	261.37' LT.	41.6003113	-81.4424125
B-009-1-23	E3	728.5	80.0	113+34.80	206.53' LT.	41.6003679	-81.4420941
H-010-0-22	C5	682.6	3.8	113+23.13	303.65' LT.	41.6005103	-81.4423975
D-010-1-22	C5	697.3	15.4	113+19.50	330.87' LT.	41.6005493	-81.4424835
D-011-0-22	C5	695.0	14.8	113+30.74	324.53' LT.	41.6005633	-81.4424385
D-011-0-22 (OFFSET)	C5	694.8		113+32.93	322.87' LT.	41.6005653	-81.4424285

4.2 LABORATORY TESTING

The laboratory testing program was developed by WSP to verify field classification of soil and rock samples, and to determine the composition and engineering properties for use in geotechnical analyses. Laboratory testing was performed by S&ME. The quantities and types of tests performed on representative samples are summarized in Table 3. Detailed laboratory test results are provided in Appendix A. Laboratory testing was also performed on hand-sampled borings for the determination of critical shear stress and erosion category following the guidelines in ODOT GDM. Sampling was performed using hand sampling techniques to a maximum depth of 6 feet below ground surface. Testing for scour analysis was also performed and included particle size distribution, moisture content, and Atterberg limits.

Table 3: Summary of Laboratory Testing

TEST PERFORMED	NUMBER OF TESTS	STANDARD TEST DESIGNATION
Sieve Analysis	99	AASHTO T 88
Hydrometer*	96	AASHTO T 88
Atterberg Limits	94	AASHTO T89/T90
Moisture Content	382	AASHTO T 265
Loss on Ignition (LOI)	7	AASHTO T 267
Specific Gravity	7	AASHTO T 100
Consolidated-Undrained Triaxial Compression	3	ASTM D 4767
Unconfined Compressive Strength of Intact Rock	13	ASTM D 7012, Method C
Unconfined Compressive Strength of Cohesive Soil	8	ASTM D 2166
Slake Durability	4	ASTM D 4644

*Short hydrometer was performed and limited to 2 hours according to ODOT SGE (July 2023)

4.3 INSTRUMENTATION

In addition to laboratory testing, field instrumentation was also performed including one inclinometer casing installed at B-001-1-22, and four (4) groundwater observation wells installed at B-001-1-22 and B-005-0-22, B-008-1-22, and B-009-1-23. Inclinometer and groundwater data were periodically collected and analyzed for a better understanding of field conditions and the causes of slope failure. The inclinometer plots indicate that movement of soil is based at about 10 feet below existing ground surface. Refer to Appendix A for inclinometer movement plots and groundwater data.

5 SUBSURFACE CONDITIONS

The subsurface soils were visually classified during drilling by S&ME personnel based on texture and plasticity. Following the completion of subsurface exploration, representative soil samples were tested in the lab and full classification was determined based ODOT Soil and Rock Classification methods presented in ODOT Specifications for Geotechnical Explorations (SGE), dated July 2022. General stratification and soil layers encountered during the investigation are presented herein. Refer to boring logs in Appendix A for detailed descriptions.

5.1 SOIL

In general, the stratigraphy consisted of surface materials, underlain by embankment fill. Below the fill, native soils were encountered underlain by bedrock. General descriptions of the soils encountered are presented in this section.

5.1.1 SURFACE MATERIALS

Surface materials on the site include asphalt pavement, granular base, and topsoil. Asphalt pavement was encountered at borings performed on existing roadway (IR-90), namely B-002-0-22 and B-008-0-22. Underneath the asphalt pavement, a layer of granular base was encountered with a thickness of 5 to 8 inches. Topsoil was encountered in the borings performed within the limits of the slope and was identified by having significant amounts of vegetation and organic materials, having a thickness of 4 to 12 inches. Natural soils are also present at the ground surface for borings performed by hand sampling techniques at the toe of the slope.

5.1.2 FILL

Underlying the surface materials, embankment fill was encountered in all of the test borings, consisting of cohesive soils including Silt and Clay, and Silty Clay identified as ODOT class A-6a and A-6b, respectively. The stiffness of the fill soils based on pocket penetrometer readings ranges from medium stiff to hard. Thin layers of granular fill were also encountered consisting of Gravel with Sand, Silt and Clay (ODOT A-2-6). It is also noted that several recovered fill samples contained traces of wood fibers, coal fragments, and roots.

Overall, the thickness of the fill layer encountered ranges from about 9.2 to 51.3 feet along the alignment. The retrieved samples from the fill had a moisture content ranging from 2 to 25 percent, with an average of about 15 percent. The SPT N_{60} values for the fill layer range from 1 to 44 blows per foot (bpf), with an average of 16.5 bpf.

Two undisturbed soil samples (Shelby tubes) from this stratum were obtained during the subsurface exploration. The results of consolidated-undrained triaxial testing for these samples indicate that the soil in this stratum has both frictional and cohesive strength properties, represented by the angle of internal friction (ϕ) and cohesion (C) as shown in Table 4 below. Refer to laboratory test results in Appendix A for more details.

Table 4: Properties of the Fill Soils from CU tests

					TOTAL STRESS		EFFECTIVE STRESS	
Boring ID	Sample No.	Depth (ft)	Elevation (ft)	Specific Gravity	Φ	C (psf)	Φ'	C' (psf)
B-001-1-22	ST-5	6.5-8.5	725.8-723.8	2.761	23.9	38	42.7	77
B-001-2-22	ST-20	7.5-9.5	719.7-717.7	2.659	20.5	187	33.6	211

5.1.3 NATURAL SOILS

Underlying the surficial materials and fill, natural soils were encountered, consisting mainly of Clay, Silt and Clay, and Silty Clay (ODOT A-7-6, A-6a, A-6b). In addition, a few thin deposits of granular materials were also observed and classified as Sand, Gravel, Gravel with Sand, and Gravel with Sand and Silt (ODOT A-3a, A-1-a, A-1-b, A-2-4). A few pockets of Sandy Silt (ODOT A-4a) were also observed in recovered soil samples. Based on pocket penetrometer readings in this stratum, the natural soils have a stiffness ranging from soft to hard.

The natural soils were encountered at the ground surface as observed during hand sampling and as deep as 53 feet at boring B-008-0-22, corresponding to elevations 682.6 to about 699.9 feet, respectively. The collected soil samples from this stratum had a moisture content ranging from 2 to 43 percent, with an average of 16.6 percent. The SPT N_{60} values for this stratum range from 7 to 62 blows per foot (bpf), with an average of about 22 bpf.

One undisturbed soil sample (Shelby tube) from this stratum was obtained during the subsurface exploration. The results of consolidated-undrained triaxial testing for this sample indicate that the soil in this stratum has both frictional and cohesive strength properties, represented by an angle of internal friction (ϕ) and cohesion (C) as shown in table 5 below.

Table 5: Properties of the Natural Soil from CU Tests

					TOTAL STRESS		EFFECTIVE STRESS	
Boring ID	Sample No.	Depth (ft)	Elevation (ft)	Specific Gravity	Φ	C (psf)	Φ'	C' (psf)
B-004-0-22	ST-15	21.0-23.0	689.4-687.4	2.709	23.6	187	31.4	287

5.2 ROCK

Bedrock was encountered in all of test borings, at depths ranging from 2.5 to 77 feet, corresponding to elevations 760.7 to 676 feet. Bedrock consisted of Shale with varying degrees of weathering and a few zones of Claystone. A summary of rock testing results is provided in Table 6 below. Refer to lab testing results in Appendix A for more information.

Table 6: Summary of Rock Testing

BORING ID	CORE NO.	DEPTH (FT)	MOISTURE CONTENT %	UNIT WEIGHT (PCF)	UC STRENGTH (PSI)	RQD (%)
B-001-1-22	NQ-11	17.9-18.3	6.9	141.3	116	37
B-001-1-22	NQ-12	23.3-23.7	5.5	147.6	441	45
B-002-0-22	NQ-41	73.6-73.9	3.7	152.6	1547	77
B-005-1-23	NQ-5	46.4-46.8	3.6	154.3	1327	52
B-005-1-23	NQ-8	60.8-61.2	3.4	154.9	1554	75
B-007-3-23	NQ-4	46.9-47.3	6.2	138	167	30
B-007-3-23	NQ-6	59.6-60	6.7	134.6	78	55
B-007-4-23	NQ-22	54.6-56	7.8	135.1	64	62
B-007-4-23	NQ-23	62.4-62.8	3.7	152.3	950	63
B-008-4-23	NQ-3	60.5-60.9	3.0	154.6	1763	13
B-008-4-23	NQ-5	69-69.4	3.6	154.8	1133	63
B-009-1-23	NQ-24	64.3-64.7	3.6	154.2	924	35
B-009-1-23	NQ-25	70.1-70.5	3.0	156.8	1448	56

5.3 GROUNDWATER

Groundwater observations were made during drilling and are noted on the boring logs. Subsequent groundwater readings were collected from the installed observation wells. Table 7 below shows groundwater data collected to date.

Table 7: Groundwater Data

MONITORING WELL	GROUND SURFACE ELEVATION (FT)	GROUNDWATER LEVEL (FT)	GROUNDWATER ELEVATION (FT)	DATE
B-001-1-22 (OW)	747.6	8.4	739.2	12/29/2022
		6.2	741.4	2/18/2023
		6.5	741.1	4/6/2023
		5.3	742.3	7/27/2023
		5.9	741.7	10/19/2023
		4.7	742.9	12/6/2023
		4.1	743.5	2/21/2024
		7.2	740.4	4/17/2024
		6.1	741.5	6/25/2024
B-005-0-22 (OW)	707.8	24.4	683.4	12/29/2022
		22.9	684.9	2/18/2023
		22.9	684.9	4/6/2023
		22.1	685.7	7/27/2023
		22.4	685.4	10/19/2023
		21.6	686.2	12/6/2023
		20.1	687.7	2/21/2024
		22.2	685.6	4/17/2024
		22.5	685.3	6/25/2024
B-008-1-22 (OW)	718.3	37	681.3	7/27/2023
		36.3	682	10/19/2023
		35.9	682.4	12/6/2023
		34.6	683.7	2/21/2024
		37.5	680.8	4/17/2024
B-009-1-23 (OW)	728.5	48	680.5	5/22/2024
		47	681.5	6/25/2024

6 STABILITY ANALYSES

Slope stability analyses were performed for the site based on existing site conditions using SLOPE/W (GeoStudio 2021.4) software package. Both short term (undrained) and long term (drained) limit equilibrium analyses were performed using the Morgenstern-Price method. Subsurface conditions represented by soil profiles were established using the borings performed as a part of this report. Cross sections of the site were obtained based on survey information performed by NEAS Inc. and used to develop the geometry for the analysis. An overall factor of safety for slope stability sliding more than 1.3 was deemed acceptable according to ODOT Geotechnical Design Manual (GDM), dated July 2024. The stations presented in this section are referenced from existing Interstate Route 90 (IR-90) alignment. Table 8 below provides a summary of the slope stability analyses performed for the two sections selected and the corresponding factors of safety.

Table 8: Summary of Slope Stability Analysis for the Existing Conditions

LOCATION	PROJECT STATION	DRAINED CONDITION	UNDRAINED CONDITION
Section 1 (I-90 Sta. 102+18.28)	Sta. 20+50.00	1.02	1.02
Section 2 (I-90 Sta. 112+49.46)	Sta. 31+00.00	0.96	1.03

6.1 SECTION-1: STATION 102+18.28

This section was selected due to observed head scarp observed near the top of the embankment, and apparent scarping at about 90 feet from the edge of roadway. The soil stratigraphy was developed based on boring information from B-001-1-22 and B-001-2-22 and historic borings. The soil properties were initially estimated based on results of laboratory testing, then refined by back-calculation of the active slide recreating failure conditions, as provided in Appendix B.

Bedrock was modeled as an impenetrable material in the analysis. A piezometric groundwater table was incorporated starting at an elevation of 740 feet as observed in groundwater observation wells within the embankment and follows the ground surface along the existing slope indicating poor drainage conditions within the embankment fill. Refer to Appendix B for model geometry and results of the analysis. A temporary access road that will be required during construction was included as a part of the analysis. A surcharge load of 250 psf was also incorporated on top of existing roadway (IR-90) and the temporary access road to represent active traffic loading during construction.

Based on the results of the analysis at this section, all the resulting shear failure surfaces are within the embankment fill. It is our understanding that the poor permeability of the embankment fill is a significant factor contributing to the slide failure at this location. A calculated shear failure surface with a factor of safety of 1.0 that reflects on-site slope instability features and inclinometer data was selected for further analysis using different repair alternatives.

6.2 SECTION-2: STATION 112+49.46

At this section, significant erosion at the toe of the slope has created slope instability. Scarping and sloughing are observed as shown in Figure 3. Scarping at this location was observed at about 73 feet from the edge of roadway. The soil stratigraphy was developed based on boring information from B-001-1-22 and B-001-2-22. A berm consisting of A-6a soil at the toe of the slope was included in the analysis. The soil properties were initially estimated based on SPT sampling and results of laboratory testing, then refined by back-calculation of the active slide recreating failure conditions.

Bedrock was modeled as an impenetrable material in the analysis. A piezometric groundwater table was incorporated starting at an elevation of 740 feet as observed in groundwater observation wells within the embankment and follows the ground surface along the existing slope indicating poor drainage conditions within the embankment fill. Refer to Appendix B for model geometry and results of the analysis., due to the need to relocate the existing creek away from the slope as shown on the project plans. A surcharge load of 250 psf was also incorporated on top of existing roadway (IR-90).

7 GEOTECHNICAL DESIGN RECOMMENDATIONS

This section provides preliminary design information for two repair solutions recommended to improve the stability of the embankment for two main locations along the alignment. The recommended slide correction alternative referenced was selected considering the constructability and feasibility of each alternative. The stations presented herein are referenced from project plans developed by WSP.

7.1 REINFORCEMENT WITH SOIL NAILS

This repair alternative consists of using soil nails installed at an inclination angle of 15 degrees from the horizontal. This approach requires excavating the embankment at a slope of 1H:1V and installing the soil nails following a "top down" construction sequencing, then installing shotcrete at the face of the excavation. Six (6) rows of soil nails spaced at four (4) feet along the ground surface with a total length of 40 feet were considered in our analysis. The analysis yielded a factor of safety of 1.3. Refer to slope stability analysis calculations in Appendix B-1 for more details.

The limits of this repair are anticipated to extend approximately from Station 20+10 to Station 21+30. Furthermore, soil nails are needed during construction to stabilize the temporary access road as shown in Figure 8. In addition, it is anticipated that bedrock may be encountered during the installation of the soil nails and specialty equipment will be required for the installation in bedrock. Figure 8 below shows a typical cross section of the repair using soil nails.

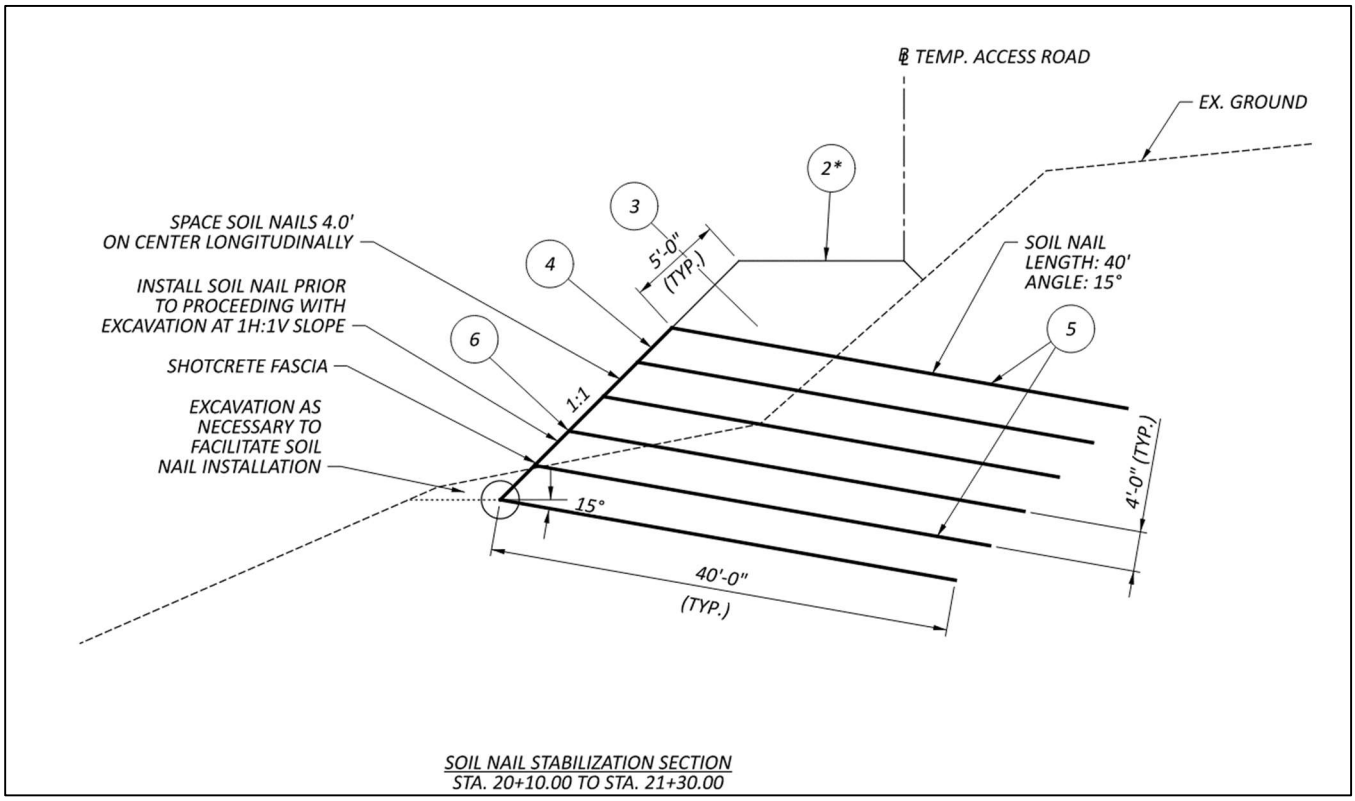

Figure 8: Typical Cross Section of Repair using Soil Nails

7.2 DRILLED SHAFT RETAINING WALL

This slope stabilization solution was selected since the bottom of the slope falls within the existing Gully Brook creek that continues to erode the toe creating slope instability. A drilled shaft wall is recommended to extend from Station 26+94.11 to Station 31+66.52 to improve the stability of the slope and to protect the embankment from failure. Design calculations are included in Appendix B-2.

This solution consists of installing 3.5-foot diameter drilled shafts spaced at 5.25 feet and extended 15 feet into competent bedrock. Plug piles installed to top of rock are also recommended to be installed between the shafts. Slope stability analyses performed using this alternative indicates that using drilled shafts will prohibit the development of weak shear planes and improves the stability of slope along the proposed wall alignment.

Based on discussions with ODOT District 12, the centerline of drilled shaft wall is to be installed at about 110 feet from the edge of roadway as shown on the proposed alignment. However, in order to construct the drilled shafts, a temporary bench must be established to create access for the drill rigs as shown on figure 9. The stability of the embankment was checked incorporating the temporary bench, and the factor of safety was estimated using slope at 1H:1V to be about 1.2. Therefore, excavation bracing was deemed necessary to provide temporary support for the excavated bench.

UA Slope software was used to estimate the forces induced on the drilled shafts by the existing slope failure. Using drilled shafts improved the factor of safety to about 1.4 for the existing slide under long term (drained) conditions. However, an extreme case was created to check the global stability of the embankment following the requirements of ODOT GDM. The maximum unfactored force per shaft was determined using UA Slope to be about 100 kips with a corresponding factor of safety of 2.85. This force was used to design the reinforcement for the drilled shafts. The maximum lateral deflection at the head of the drilled shaft was checked using Lpile software to be less than 1% of pile length above bedrock. See drilled shaft wall calculation package in Appendix B-3 for more information.

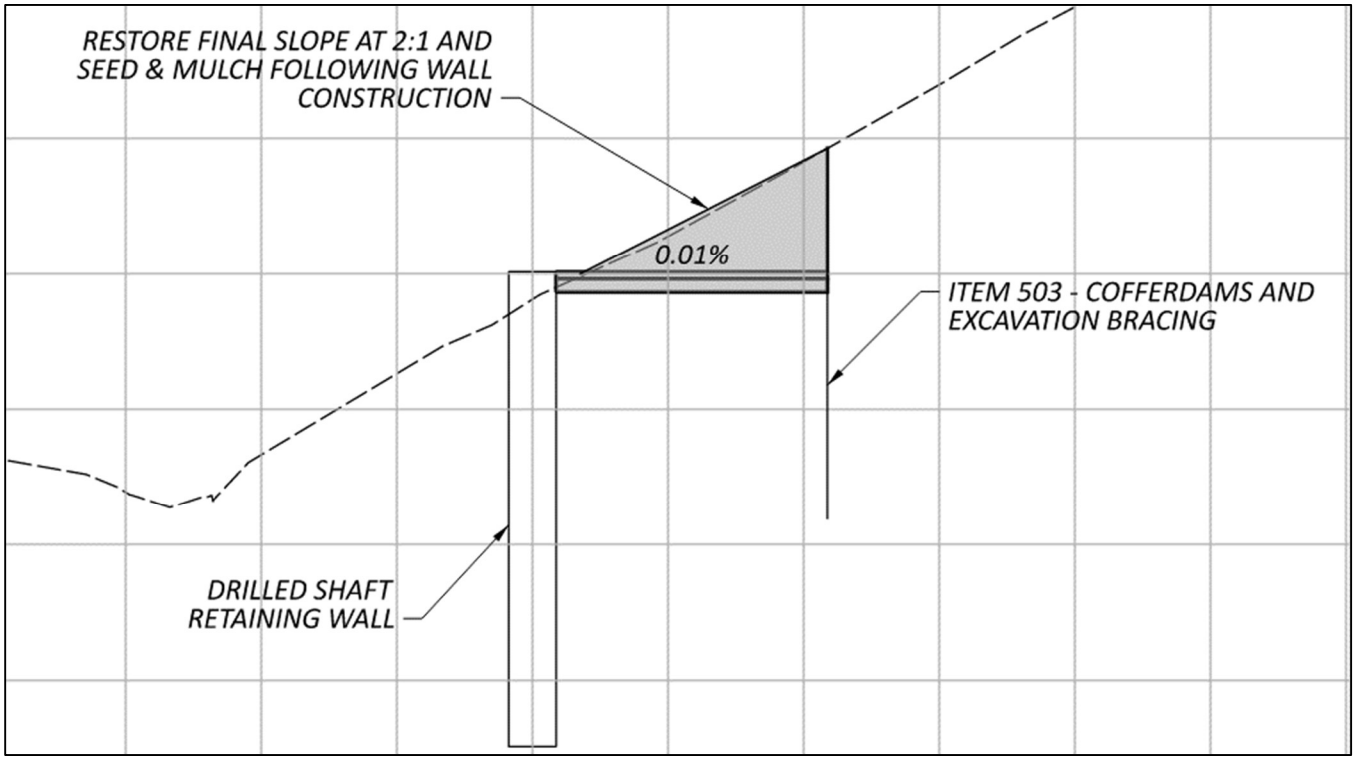

Figure 9: Cross Section of Drilled Shaft Wall at Station 31+00

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APPENDIX

A GEOTECHNICAL DATA REPORT

Geotechnical Data Report, Revision #1
LAK-90-2.93 Landslide
PID 112663
Willoughby Hills, Lake County, Ohio
S&ME Project No. 22170059B

PREPARED FOR:

WSP USA
115 W. Washington St., Ste 1270S
Indianapolis, IN 46204

PREPARED BY:

S&ME, Inc.
6190 Enterprise Court
Dublin, OH 43016

June 28, 2024

June 28, 2024

WSP USA
115 W. Washington St., Ste 1270S
Indianapolis, IN 46204

Attention: Mr. Michael Flanagan, P.E.
E: michael.flanagan@wsp.com

Reference: **Geotechnical Data Report, Revision #1**
LAK-90-2.93 Landslide (PID No. 112663)
Willoughby Hills, Lake County, Ohio
S&ME Project No. 22170059B

Dear Mr. Flanagan:

In accordance with our revised proposal dated September 9, 2022, which was authorized by WSP USA (WSP) on November 14, 2022, S&ME, Inc. (S&ME) has completed a Geotechnical Exploration for the LAK-90-2.93 Landslide project in Willoughby Hills, Ohio. The purpose of the field exploration is for a slope failure along the north shoulder of IR 90. Please see the approximate location in Vicinity Map, Plate 1 of the Appendix. This report has been revised to include the results of the exploration and testing of the two (2) mid-slope borings of the original exploration which were previously postponed due to hazardous ground and slope conditions.

Additionally, S&ME was requested to perform five (5) additional borings for a proposed retaining wall as discussed in our Request for Modification #2 dated December 14, 2023, which was authorized by WSP on April 25, 2024. This report includes the results of the exploration and testing of these additional five (5) retaining wall borings. Finally, this report also addresses comments from ODOT that were provided to S&ME by WSP on May 30, 2024, and supersedes our original data report dated April 24, 2023.

We appreciate being given the opportunity to be of service. Please do not hesitate to contact our office if you have any questions concerning our report.

Sincerely,

S&ME, Inc.

Brian K. Sears, P.E.
Senior Engineer | Project Manager

Benjamin C. Dusina, P.E.
Principal Engineer | Senior Reviewer

Submitted: Electronic copy via email

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Appendix I – General Information, Logs & Photographs

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1.0 Introduction

The LAK-90-2.93 Slope Repair project includes three (3) landslides at the following locations, LAK-90-2.93, LAK-90-12.39 and GEA-322-5.76. At the direction of WSP, S&ME has performed a geohazard exploration at the two (2) LAK-90 sites. This report will discuss the exploration for at the LAK-90-2.93 site only. The Geotechnical Data Report for the LAK-90-12.39 site will be submitted under separate cover.

The Geotechnical Exploration at the LAK-90-2.93 site has been performed in general accordance with the January 2024 update of the ODOT *Specifications for Geotechnical Investigations* (*SGE*).

2.0 Site Reconnaissance

S&ME visited the site on April 28, May 13 and July 20, 2022, to observe slope conditions and assess site access constraints. The July 20, 2022, visit was performed with representatives from WSP and ODOT D12. This site includes multiple landslide features within the approximately 1,300-foot-long section of fill embankment for IR 90. S&ME observed approximately six (6) locations with significant slope failure, primarily focused along the toe of the slope where a meandering drainage channel has eroded channel banks and created over-steepened slopes. In some locations, slope instability has progressed up the slope as the lower portion of the slope failed. Three (3) culverts with outlets/inlets exist along the toe of the slope. This site includes an existing toe buttress constructed along with the original construction of IR 90 when an embankment failure occurred during construction.

3.0 Exploration

3.1 Field Investigation

S&ME re-visited the site on November 21, 2022, to mark the locations of the proposed boring locations which includes ten (10) soil borings, five (5) Wildcat Dynamic Cone Penetrometer (DCP) soundings and five (5) hand sampled borings. Eight (8) of the soil borings, termed B-001-0-22, B-001-1-22, B-001-2-22, B-002-0-22, B-003-0-22, B-004-0-22, B-005-0-22 and B-008-0-22 were drilled to depths ranging from 24.2 to 77.4 feet. The boring numbers will hereafter be referred to without their year designations (e.g., B-001-0, B-002-0, etc.). The borings were drilled between December 1 and 15, 2022.

Access to Borings B-007-0-22 and B-008-1-22 was proposed to be achieved by means of constructing a bench with a bulldozer. However, during drilling, wet weather and ground conditions caused S&ME to be concerned that creating an approximately 375-foot-long bench could become a potential hazard to the existing fill slope. Due to the potential hazards, S&ME requested that the drilling at Borings B-007-0-22 and B-008-1-22 could be postponed until more favorable (dry) weather and ground conditions exist. The request to postpone drilling at these two locations was approved by WSP and ODOT in an email exchange on December 7, 2022. S&ME remobilized to the site from July 17 to 19, 2023, to complete Borings B-007-0 and B-008-1 when the site and slope conditions were conducive to the safe performance of the borings.

S&ME returned to the site again on April 17, 2024, to mark the locations of the five (5) retaining wall borings. Three (3) of the retaining wall borings (B-005-1-23, B-007-3-23 and B-008-4-23) were immediately adjacent to

previously drilled borings (B-005-0-22, B-007-0-22 and B-008-1-22, respectively) to obtain rock core information. The two (2) remaining retaining wall borings (B-007-4-23 and B-009-1-23) were new boring locations with soil and rock sampling obtained. The borings will hereafter referred be to without their year designations. A dozer and operator arrived at the site on May 13, 2024, to cut a bench in the slope to allow access to the retaining wall borings. While creating access to the slope, the monitoring well previously installed in Boring B-008-1 was abandoned. Drilling for the five (5) retaining wall borings was completed between May 13 and May 24, 2024. The benched slope was repaired May 31, 2024.

The borings were advanced by ATV-mounted drill rigs using a 3¼-inch or 4¼-inch hollow-stem auger. Disturbed, but representative, soil samples were attempted by lowering a 2-inch O.D. split-barrel sampler through the auger stem to the bottom of the boring and then driving the sampler into the soil with blows from a 140-pound hammer freely falling 30 inches (AASHTO T206 – Standard Penetration Test, SPT). The three (3) redrilled borings (B-005-1, B-007-3 and B-008-4) were performed with no SPT sampling until the bottom of the soil profile to confirm that coreable bedrock had been encountered. Shelby tubes were attempted in the original borings and in the retaining wall borings in accordance with criteria provided by WSP.

In accordance with ODOT specifications, the hammer system on the ATV D50 drilling rig was calibrated (ASTM D4633) on December 22, 2022, to determine the drill rod energy ratio (79.1%). We note that this calibration date is slightly after the borings were performed in November/December 2022. The prior calibration date was November 25, 2020, with a drill rod energy ratio of 82.1%. Scheduling delays inhibited the hammer system being recalibrated prior to work being performed at the site and within the 2-year timeframe discussed in the *SGE*. Accordingly, the hammer was calibrated as soon as possible after the 2022 drilling was completed and the new drill rod energy ratio was used in connection with the boring logs submitted for this project. The hammer system on the CME 550X ATV rig that was used to drill three (3) of the retaining wall borings in May 2023 was calibrated on April 28, 2023, and has an energy ratio of 85.0%.

The five (5) Wildcat DCPs, termed D-007-1-22, D-008-2-22, D-009-1-22, D-010-0-22 and D-011-0-22 were performed on February 2, 2023, and extended to depths ranging from 7.4 to 15.3 feet. As with the borings, the DCPs will hereafter be referred to without their year designations (e.g., D-007-1, D-008-2, etc.). The Wildcat DCP includes a 35-pound enclosed hammer freely falling approximately 18 inches down a guide rod striking an anvil. Below the anvil, steel rods marked at tenth meter increments are attached to reach the desired depth with a sacrificial conical point at the base. The number of blows required to drive the rods each tenth meter increment are recorded. The number of blows is entered into a manufacturer provided spreadsheet to estimate relative density/stiffness of the soils encountered.

Finally, the five (5) hand sampled borings, termed H-004-1-22, H-006-0-22, H-007-2-22, H-008-3-22 and H-010-0-22 were performed on February 1, 2023, and extended to depths ranging from 4.5 to 6.0 feet. As with the soil borings, the hand sampled borings will hereafter be referred to without their year designations (e.g., H-004-1, H-006-0, etc.). Hand sampling includes a 35-pound hammer freely falling 18 inches down a guide rod striking an anvil. Below the anvil, steel rods are attached to reach the desired depth with a 2-inch O.D. split-barrel sampler at the base of the assembly.

Inclinometer casing was installed in Boring B-001-1 to a depth of 25 feet after completion of the rock core sampling. Groundwater monitoring wells, using a 10-foot section of slotted PVC pipe surrounded by sand filter material were installed in an offset to Boring B-001-1 and in Borings B-005-0 and B-008-1. As previously noted, the monitoring well installed in Boring B-008-1 was abandoned when a new bench was cut to allow access for the

new retaining wall borings and a new monitoring well was installed in Boring B-009-1. Initial baseline readings at instruments in Borings B-001-1 and B-005-0 were obtained on December 29, 2022, and follow up readings were obtained on February 18, April 6, and July 27, 2023. The July 27, 2023, readings included an initial baseline reading at the monitoring well at B-008-1. Follow up readings requested by WSP were obtained on October 19, 2023, December 6, 2023, February 21, 2024, April 17, 2024, and June 25, 2024. The June 25, 2024, readings included an initial baseline reading at the new monitoring well at B-009-1. Plots of the inclinometer data and summary tables of the water well readings are provided in Appendix III.

The soil samples were examined in the field and representative portions were preserved in airtight glass jars. Rock core samples were stored in compartmented cardboard or wood boxes. Following the completion of drilling, the borings were backfilled with cuttings mixed with bentonite or sealed with a bentonite-cement grout, and a plastic hole plug was placed in the borehole a few feet below the surface. At Borings B-002-0 and B-008-0, the existing IR 90 shoulder pavement was patched with an equivalent thickness of cold patch asphalt.

Soil samples were delivered to S&ME's lab for further examination and testing. Coordinates of boring locations were surveyed by WSP personnel or were obtained by S&ME using a handheld GPS and provided to WSP. The stations, offsets, and ground surface elevations at boring/DCP locations were provided by WSP.

In the field, experienced personnel from S&ME observed the drilling procedures and performed the following specific duties: preserved all recovered samples; prepared a log of each boring; made seepage and groundwater observations in the borings; obtained hand-penetrometer measurements in soil samples exhibiting cohesion; and, provided liaison between the fieldwork and the Project Manager so that the program of exploration could be modified, if necessary, because of unanticipated conditions.

3.2 Laboratory Testing

In the laboratory, the soil samples were visually identified and tested for natural moisture content, liquid/plastic limit determinations and grain-size analyses. Results of the laboratory index tests are recorded numerically on the boring log and a summary of the index test results is also included in Appendix II. Results output of additional strength or durability testing (consolidated undrained triaxial, slake durability and unconfined compressive strength) performed on recovered soil or rock samples are provided in Appendix II.

Based upon the results of the laboratory testing program, the field logs were modified, if necessary, and a copy of the laboratory corrected boring logs are submitted as Plates 5 through 43 of Appendix I. Shown on these logs are: descriptions of the soil stratigraphy encountered; depths from which samples were preserved; sampling efforts (blow-counts) required to obtain the specimens in the borings; calculated N_{60} values; laboratory testing results; seepage and groundwater observations made at the time of drilling; values of hand-penetrometer measurements made in soil samples exhibiting cohesion; and, RQD (rock quality designation) and recovery percentages of rock core samples. For your reference, hand-penetrometer values are roughly equivalent to the unconfined compressive strength of the cohesive fraction of the soil sample.

Soils have been classified in general accordance with Section 603 of the ODOT *SGE* and described in general in accordance with Section 602. Bedrock has been classified and described in general accordance with Section 605 of the ODOT *SGE*. An explanation of the symbols and terms used on the boring logs, definitions of the special adjectives used to denote the minor soil components, description of rock, and information pertaining to sampling

and identification are presented on Plate 3 and 4 of Appendix I. Group Indices determined from the results of the laboratory testing program are also provided on the boring logs.

4.0 Findings

Please refer to the boring logs (Plates 5 through 43 in Appendix I) for the soil, bedrock, and groundwater/seepage conditions encountered at each boring location. Inferences should not be made to the subsurface conditions in the areas away from the boring without performance of additional borings or other field verification.

5.0 Critical Shear Stress for Scour Analysis

The Critical Shear Stress was estimated using the appropriate equations for cohesive or granular soils as directed in Section 1302 of the ODOT *Geotechnical Design Manual* (*GDM*). The equations are a function of the D_{50} particle size as determined in the laboratory, water content, fraction of fine particles (silt and clay sizes), plasticity index and unconfined compressive strength of the soil.

Table 5-1, on the following page, presents laboratory determined D_{50} particle size, Critical Shear Stress (τ_c), $D_{50,equivalent}$, and Erosion Category (EC) from gradation testing of the soil samples recovered from the continuously sampled zone in the five (5) hand-sampled borings performed at the site. This information may be used by others to perform a scour analysis in accordance with HEC-18. This data was originally provided to WSP in Geotechnical Design Memorandum (GDM #1) dated March 30, 2023.

Table 5-1 Scour Zone Particle Size and Critical Shear Stress

Boring Number	Sample ID	Sample Elevation	Lab D_{50} (mm)	Critical Shear τ_c (psf)	Erosion Category	$D_{50,equivalent}$ (mm)
H-004-1-22	SS-1	687.4' - 685.9'	0.4463	0.0178	3.07	0.8506
	SS-2	685.9' - 684.4'	0.5134	0.0107	1.85	0.5134
	SS-3	684.4' - 682.9'	0.4168	0.0731	3.41	3.4986
	SS-4	682.9' - 681.4'	1.7609	0.0368	2.49	1.7609
H-006-0-22	SS-1	686' - 684.5'	5.94	0.1241	3.13	5.9400
	SS-2	684.5' - 683'	0.012	0.0373	3.41	1.7848
	SS-3	683' - 681.5'	0.0288	0.0171	3.07	0.8179
	SS-4	681.5' - 680'	0.0606	0.0214	3.07	1.0268
H-007-2-22	SS-1	685.3' - 683.8'	3.9322	0.0821	2.91	3.9322
	SS-2	683.8' - 682.3'	1.7755	0.0371	2.50	1.7755
	SS-3	682.3' - 680.8'	2.5334	0.0529	2.68	2.5334
	SS-4	680.8' - 679.3'	0.2367	0.0049	1.45	0.2367
H-008-3-22	SS-1	683.3' - 681.8'	0.946	0.0198	2.17	0.9460
	SS-2	681.8' - 680.3'	2.0092	0.0420	2.56	2.0092
	SS-3	680.3' - 678.8'	5.2423	0.1095	3.06	5.2423
H-010-0-22	SS-1	682.6' - 681.1'	0.018	0.0911	3.48	4.3622
	SS-2	681.1' - 679.6'	0.028	0.1406	3.41	6.7303
	SS-3A	679.6' - 679.1'	0.2312	0.1157	3.07	5.5379

6.0 Final Considerations

This data report has been prepared in accordance with generally accepted geotechnical engineering practice for specific application to this project. The conclusions and recommendations contained in this report are based upon applicable standards of our practice in this geographic area at the time this report was prepared. No other representation or warranty either express or implied, is made.

We relied on project information given to us to develop our exploration plan. If project information described in this report is not accurate, or if it changes during project development, we should be notified of the changes.

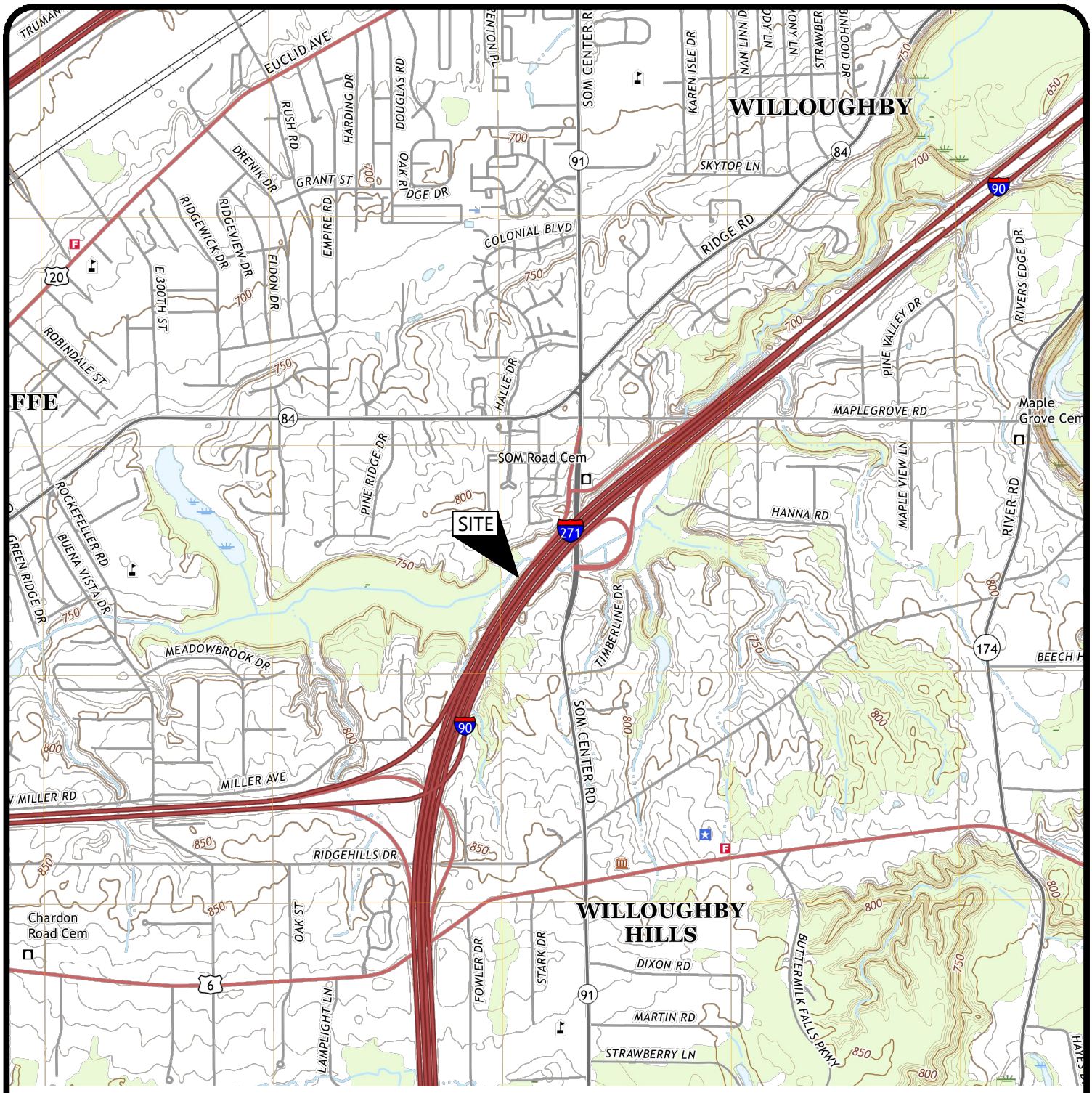
Our data and observations are based on limited data from a field exploration program. Subsurface conditions can vary widely between explored areas. Some variations may not become evident until construction. If conditions are encountered that appear different than those described in our report, we should be notified. This report should not be construed to represent subsurface conditions for the entire site.

Unless specifically noted otherwise, our field exploration program did not include an assessment of regulatory compliance, environmental conditions or pollutants or presence of any biological materials (mold, fungi, bacteria).

If there is a concern about these items, other studies should be performed. S&ME can provide a proposal and perform these services if requested.

Appendices

Appendix I – General Information, Logs & Photographs



N

Project Location
Lake County, Ohio

USGS Mapping:
Mayfield Heights USGS Quad

0 2000 4000
GRAPHIC SCALE (IN FEET)

Vicinity Map

Geohazard Exploration
LAK-90-2.93 Landslide
Willoughby Hills, Lake County, Ohio

SCALE:	FIGURE NO.
GRAPHIC	1
DATE:	
04-03-2023	
PROJECT NUMBER	
22170059B	

Drawing Path: T:\Columbus-1170\Projects\2022\22170059B_WSP_LAK-90-2.93_Cleveland OH\4 GEO\CAD\Construction\Plan of Borings.dwg

NOTES: AERIAL IMAGERY COURTESY OF OGRIP, OBTAINED SPRING 2017. BORINGS WITH A "23" YEAR DESIGNATION WERE PERFORMED FOR THE PROPOSED RETAINING WALL.

N

0 200 400

GRAPHIC SCALE (IN FEET)

LEGEND

B-001-0-22 BORING NUMBER AND LOCATION

H-001-0-22 HAND SAMPLE BORING NUMBER AND LOCATION

D-001-0-22 DCP SOUNDING NUMBER AND LOCATION

Plan of Borings

Geohazard Exploration
LAK-90-2.93 Landslide
Willoughby Hills, Lake County, Ohio

SCALE:	FIGURE NO.
GRAPHIC	2
DATE:	
06-24-2024	
PROJECT NUMBER	
22170059B	

Drawing Path: T:\Columbus-1170\Projects\2022\22170059B_WSP_LAK-90-2.93_Cleveland OH\4 GEO\CAD\Construction\Plan of Borings.dwg

EXPLANATION OF SYMBOLS AND TERMS USED ON BORING LOGS FOR SAMPLING AND DESCRIPTION OF SOIL

SAMPLING DATA

- ▯ - Indicates sample was attempted within this depth interval.
- 2 / 3 / 5 - The number of blows required for each 6-inch increment of penetration of a "Standard" 2-inch O.D. split-barrel sampler, driven a distance of 18 inches by a 140-pound hammer freely falling 30 inches (SPT). The raw "blowcount" or "N" is equal to the sum of the second and third 6-inch increments of penetration.
- N_{60} - Corrected Blowcount = [(Drill Rod Energy Ratio) / (0.60 Standard)] X N
- SS - Split-barrel sampler, any size.
- ST - Shelby tube sampler, 3″ O.D., hydraulically pushed.
- R - Refusal of sampler in very-hard or dense soil, or on a resistant surface.
- 50-4" - Number of blows (50) to drive a split-barrel sampler a certain distance (4 inches), other than the normal 6-inch increment.

DEPTH DATA

- W - Depth of water or seepage encountered during drilling.
- ▽ - Depth to water in boring at the end of drilling (EOD).
- ▼ 5 days - Depth to water in monitoring well or piezometer in boring a certain number of days (5) after termination of drilling.
- TR - Depth to top of rock.

SOIL DESCRIPTIONS

Soils have been classified in general accordance with Section 603 of the most recent ODOT SGE, and described in general accordance with Section 602, including the use of special adjectives to designate approximate percentages of minor components as follows:

Adjective	Percent by Weight
trace	1 to 10
little	10 to 20
some	20 to 35
"and"	35 to 50

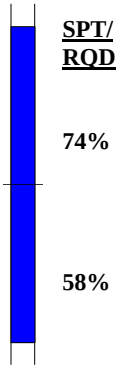
The following terms are used to describe density and consistency of soils:

Term (Granular Soils)	Blows per foot (N_{60})
Very-loose	Less than 5
Loose	5 to 10
Medium-dense	11 to 30
Dense	31 to 50
Very-dense	Over 50

Term (Cohesive Soils)	Qu (tsf)
Very-soft	Less than 0.25
Soft	0.25 to 0.5
Medium-stiff	0.5 to 1.0
Stiff	1.0 to 2.0
Very-stiff	2.0 to 4.0
Hard	Over 4.0

EXPLANATION OF SYMBOLS AND TERMS USED ON BORING LOGS FOR SAMPLING AND DESCRIPTION OF ROCK

SAMPLING DATA



When bedrock is encountered and rock core samples are attempted, the length of core recovered and lost during the core run is reported in the "REC" column. The type of rock core barrel utilized is recorded under the heading "Sampling Method" at the top of the boring log, and also in the "SAMPLE ID" column. Rock-core barrels can be of either single- or double-tube construction, and a special series of double-tube barrels, designated by the suffix M, may also be used to obtain maximum core recovery in very-soft or fractured rock. Four basic groups of barrels are used most often in subsurface investigations for engineering purposes, and these groups and the diameters of the cores obtained are as follows:

AX, AW, AXM, AWM	-	1-1/8 inches
BX, BW, BXM, BWM	-	1-5/8 inches
NX, NW, NXM, NWM	-	2-1/8 inches
NQ, NQ2	-	1-7/8 inches

Rock Quality Designation (RQD) is expressed as a percentage and is obtained by summing the total length of all core pieces which are at least 4 inches long and then dividing this sum by, either, the total length of core run or the length of the core run in a particular bedrock stratum. The RQD value is reported as a percentage in the "SPT/RQD" column. It has been found that there is a reasonably good relationship between the RQD value and the general quality of rock for engineering purposes. This relationship is shown as follows:

RQD - %	General Quality
0 - 25	Very-poor
25 - 50	Poor
50 - 75	Fair
75 - 90	Good
90 - 100	Excellent

ROCK HARDNESS

Recovered bedrock samples are described in general accordance with Section 605 of the 2007 ODOT SGE and subsequent revisions, where necessary. The following terms are used to describe rock hardness:

Term	Meaning
Very Weak	Rock can be excavated readily with the point of a pick and carved with a knife. Pieces 1 inch or greater in thickness can be broken by finger pressure. Can be scratched with a fingernail.
Weak	Rock can be grooved or gouged readily by a knife or pick, and can be excavated in small fragments with moderate blows from a pick point. Small, thin pieces may be broken with finger pressure.
Slightly Strong	Rock can be grooved or gouged 0.05 inches deep with firm pressure from a knife or pick point, and can be excavated in small chips to pieces of 1 inch maximum size using hard blows from the point of a geologist's pick.
Moderately Strong	Rock can be scratched with a knife or pick. Grooves or gouges to ¼ inch deep can be excavated by hard blows of a geologist's pick. Requires moderate hammer blows to detach a hand specimen.
Strong	Rock can be scratched with a knife or pick only with difficulty. Requires hard hammer blows to detach a hand specimen. Sharp and resistant edges are present on hand specimens.
Very Strong	Rock cannot be scratched by a knife or sharp pick. Breaking of hand specimens requires repeated hard blows of a geologist's hammer.
Extremely Strong	Rock cannot be scratched by a knife or sharp pick. Chipping of hand specimens requires repeated hard blows of a geologist's hammer.

S&ME JOB: 22170059B

PROJECT: LAK-90-2.93 SLIDE	DRILLING FIRM / OPERATOR: OTB / J. MINCHAK	DRILL RIG: OTB ATV D50	STATION / OFFSET: 101+91, 168' LT
TYPE: LANDSLIDE	SAMPLING FIRM / LOGGER: S&ME / S. SMITH	HAMMER: CME AUTOMATIC	ALIGNMENT: IR-90
PID: 112663 BR ID: N/A	DRILLING METHOD: 3-1/4" HSA	CALIBRATION DATE: 12/22/22	ELEVATION: 763.2 (MSL) EOB: 24.2 ft.
START: 12/6/22 END: 12/6/22	SAMPLING METHOD: SPT	ENERGY RATIO (%): 79.1	LAT / LONG: 41.597580 N, 81.444836 W

EXPLORATION ID **B-001-0-22**

PAGE 1 OF 1

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	BACK FILL
TOPSOIL - 12 INCHES	763.2																	
	762.2																	
Brown, red and gray **SILT AND CLAY**, many shale fragments.	760.7																	
SHALE, reddish brown, severely weathered, very weak, many zones of clay, similar to hard silty clay.		TR	4 12 16	37	100	SS-1	-	-	-	-	-	-	-	-	-	12	Rock (V)	
			10 16 24	53	100	SS-2A	-	-	-	-	-	-	-	-	-	10	Rock (V)	
						SS-2B	-	-	-	-	-	-	-	-	-	5	Rock (V)	
@ 5.5' grayish brown						SS-3A	-	-	-	-	-	-	-	-	-	10	Rock (V)	
	756.2		11 19 21	53	100	SS-3B	-	-	-	-	-	-	-	-	-	7	Rock (V)	
SHALE, gray, highly to severely weathered, very weak.			13 23 26	65	100	SS-4	-	13	17	17	35	18	36	23	13	7	Rock (V)	
			24 50/5"	-	100	SS-5	-	-	-	-	-	-	-	-	-	5	Rock (V)	
			36 50/5"	-	100	SS-6	-	-	-	-	-	-	-	-	-	6	Rock (V)	
			34 50/3"	-	89	SS-7	-	-	-	-	-	-	-	-	-	5	Rock (V)	
	749.2		50	-	100	SS-8	-	-	-	-	-	-	-	-	-	4	Rock (V)	
SHALE, dark gray, moderately to highly weathered, very weak, thinly laminated to laminated, fissile, moderately to highly fractured, narrow to open, slightly rough, few zones of claystone, RQD = 29%, REC = 96%.			27		98	NQ-9											CORE	
@ 14.0' to 18.9' SDI = 71.5%.																		
	739.0	EOB	31		94	NQ-10											CORE	

NOTES:
- The upper 2.5' of the original ground surface was cut out by the dozer when creating access to the site. Layering in the upper 2.5' is based on observations of the dozer cut.
- No groundwater encountered prior to bedrock coring.

NOTES: SEE ABOVE.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PLASTIC HOLE PLUG DEVICE; SOIL CUTTINGS MIXED WITH BENTONITE

S&ME ODOT LOG (8.5X11) - SGE 01/2019 - OH DOT.GDT - 6/28/24 15:06 - R:\SERVICE LINES\CS-2557\CLEVELAND\01 - LABORATORY\02 - GINT\WPROJECTS\22170059B-NEW.GPJ

PLATE 5

S&ME JOB: 22170059B

PROJECT: LAK-90-2.93 SLIDE	DRILLING FIRM / OPERATOR: OTB / J. MINCHAK	DRILL RIG: OTB ATV D50	STATION / OFFSET: 102+39, 190' LT	EXPLORATION ID B-001-1-22
TYPE: LANDSLIDE	SAMPLING FIRM / LOGGER: S&ME / S. SMITH	HAMMER: CME AUTOMATIC	ALIGNMENT: IR-90	
PID: 112663 BR ID: N/A	DRILLING METHOD: 3-1/4" HSA	CALIBRATION DATE: 12/22/22	ELEVATION: 746.8 (MSL) EOB: 25.1 ft.	PAGE 1 OF 1
START: 12/7/22 END: 12/7/22	SAMPLING METHOD: SPT / ST	ENERGY RATIO (%): 79.1	LAT / LONG: 41.597818 N, 81.444404 W	

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	INCL.
FILL: Medium-stiff to stiff brown to gray **SILT AND CLAY**, little fine to coarse sand, trace fine gravel, damp to moist.	746.8		1 1 2	4	78	SS-1	0.75-1.25	9	9	9	36	37	35	20	15	19	A-6a (10)	
			1 1 2	4	17	SS-2	1.25	-	-	-	-	-	-	-	-	18	A-6a (V)	
		W 742.6	1 1 2	4	17	SS-3	0.75-1.0	-	-	-	-	-	-	-	-	19	A-6a (V)	
	742.0		1 1 0	1	33	SS-4A	1.0	-	-	-	-	-	-	-	-	16	A-6a (V)	
FILL: Medium-stiff to stiff gray **SILT AND CLAY**, some fine gravel, little fine to coarse sand, damp.						SS-4B	-	-	-	-	-	-	-	-	-	17	A-6a (V)	
		120 days			50	ST-5	0.75-1.25	21	7	6	36	30	34	21	13	17	A-6a (7)	
	738.3	22 days																
POSSIBLE FILL: Very-stiff gray **SILTY CLAY**, little fine to coarse sand, trace fine gravel, moist.	736.8		2 3 4	9	89	SS-6	2.3-3.0	-	-	-	-	-	-	-	-	19	A-6b (V)	
Hard brown **SILTY CLAY**, little fine to coarse sand, trace fine gravel, many weathered shale fragments, damp to moist.			3 8 11	25	67	SS-7	4.5+	7	7	7	43	36	37	21	16	14	A-6b (10)	
	733.8		10 21 26	62	100	SS-8	4.5+	-	-	-	-	-	-	-	-	15	A-6b (V)	
SHALE, gray, highly to severely weathered, very weak, similar in structure to hard silty clay.		TR	26 41	-	100	SS-9	-	-	-	-	-	-	-	-	-	9	Rock (V)	
	731.8		26 50	-	83	SS-10	-	-	-	-	-	-	-	-	-	8	Rock (V)	
SHALE, gray, moderately to highly weathered, very weak, thinly laminated to laminated, fissile, moderately to highly fractured, narrow to open, slightly rough, few zones of claystone, RQD = 41%, REC = 97%. @ 17.9' to 18.3' Q_u = 116 psi, γ_{dry} = 141.3 pcf			37		96	NQ-11	-										CORE	
@ 19.5' to 25.1' SDI = 62.1%			45		97	NQ-12	-										CORE	
@ 23.3' to 23.7' Q_u = 441 psi, γ_{dry} = 147.6 pcf	721.7	EOB																

NOTES:
- Encountered seepage at 4.2' during drilling.
- Installed inclinometer to a depth of 25'.
- Installed groundwater monitoring well in offset hole located 10' southwest of original.

NOTES: SEE ABOVE.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: BENTONITE AND CEMENT GROUT MIXTURE; INCLINOMETER

S&ME ODOT LOG (8.5X11) - SGE 01/2019 - OH DOT.GDT - 6/28/24 15:06 - R:\SERVICE LINES\CS-2557\CLEVELAND\01 - LABORATORY\02 - GINT\WPROJECTS\22170059B-NEW.GPJ

PLATE 6

S&ME JOB: 22170059B

PROJECT: LAK-90-2.93 SLIDE	DRILLING FIRM / OPERATOR: OTB / J. MINCHAK	DRILL RIG: OTB ATV D50	STATION / OFFSET: 102+64, 256' LT	EXPLORATION ID B-001-2-22
TYPE: LANDSLIDE	SAMPLING FIRM / LOGGER: S&ME / S. SMITH	HAMMER: CME AUTOMATIC	ALIGNMENT: IR-90	
PID: 112663 BR ID: N/A	DRILLING METHOD: 3-1/4" HSA	CALIBRATION DATE: 12/22/22	ELEVATION: 727.2 (MSL) EOB: 28.0 ft.	PAGE 1 OF 1
START: 12/8/22 END: 12/8/22	SAMPLING METHOD: SPT / ST	ENERGY RATIO (%): 79.1	LAT / LONG: 41.597971 N, 81.444562 W	

MATERIAL DESCRIPTION AND NOTES	ELEV. 727.2	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GR	CS	FS	SI	CL	LL	PL	PI	WC	ODOT CLASS (GI)	BACK FILL
TOPSOIL/ROOTMAT - 4 INCHES	726.9		1			SS-1A	-	-	-	-	-	-	-	-	-	-	Visual (V)	
FILL: Medium-stiff to stiff brown **SILT AND CLAY**, little fine to coarse sand, little fine gravel, damp to moist.	724.2	1	1 2	4	100	SS-1B	0.5-1.5	-	-	-	-	-	-	-	-	20	A-6a (V)	
		2	2 4	8	61	SS-2	1.25-2.5	-	-	-	-	-	-	-	-	16	A-6a (V)	
FILL: Very-stiff to hard dark brown to gray **SILT AND CLAY**, little fine to coarse sand, little fine gravel, damp.		3	4 6 6	16	100	SS-3	4.5	14	7	8	35	36	32	18	14	13	A-6a (9)	
		4	3 4 5	12	89	SS-4	3.5-4.5+	-	-	-	-	-	-	-	-	15	A-6a (V)	
@ 6.5' wood fragments	719.7	5	3 5 4	12	89	SS-5	2.0-3.0	-	-	-	-	-	-	-	-	13	A-6a (V)	
PROBABLE FILL: Stiff to very-stiff gray **SILT AND CLAY**, trace to little fine to coarse sand, trace to little fine gravel, slightly organic, damp to moist.		6	2 4 4	11	100	SS-6	1.5-2.5	15	9	9	35	32	33	21	12	20	A-6a (7)	
- Shelby tube (ST-20) obtained in offset hole from 7.5' to 9.5'. @ 7.5' to 9.5' LOI = 3.1%.	717.7					ST-20	1.5-2.25	2	4	5	43	46	39	23	16	25	A-6b (10)	
		7	2 5 6	15	89	SS-7A	1.25	-	-	-	-	-	-	-	-	21	A-6a (V)	
						SS-7B	2.5-3.0	-	-	-	-	-	-	-	-	19	A-7-6 (V)	
Very-stiff to hard brown **CLAY**, some silt, little fine to coarse gravel, little fine to coarse sand, few shale fragments, damp.		8	6 8 11	25	100	SS-8	3.5-4.5+	15	7	4	31	43	41	20	21	16	A-7-6 (12)	
		9	3 6 10	21	67	SS-9	4.5+	-	-	-	-	-	-	-	-	14	A-7-6 (V)	
		10	4 7 10	22	39	SS-10	3.5-4.5	-	-	-	-	-	-	-	-	14	A-7-6 (V)	
	710.7	11	7 9 11	26	78	SS-11	3.0-4.5+	-	-	-	-	-	-	-	-	16	A-7-6 (V)	
Very-stiff to hard light to dark-brown **SILTY CLAY**, some fine to coarse gravel, little fine to coarse sand, few shale fragments, damp to moist.		12	10 10 14	32	100	SS-12	4.5+	23	7	6	29	35	37	20	17	11	A-6b (9)	
		13	6 8 9	22	61	SS-13	3.5-4.5+	-	-	-	-	-	-	-	-	14	A-6b (V)	
	707.1	14	3 7 11	24	67	SS-14A	2.5	-	-	-	-	-	-	-	-	21	A-6b (V)	
Very-stiff to hard gray with brown **CLAY**, "and" silt, trace fine to coarse sand, trace fine gravel, becoming similar to severely weathered shale, damp.						SS-14B	2.5	-	-	-	-	-	-	-	-	18	A-7-6 (V)	
		15	4 8 11	25	100	SS-15	3.5-4.5+	3	3	5	38	51	42	22	20	15	A-7-6 (12)	
		16	7 10 10	26	67	SS-16	4.5+	-	-	-	-	-	-	-	-	15	A-7-6 (V)	
	701.7	17	5 8 9	22	100	SS-17	4.5+	-	-	-	-	-	-	-	-	16	A-7-6 (V)	
SHALE, gray, highly to severely weathered, very weak, few clay infill zones.		W TR 701.7	48	-	100	SS-18	-	-	-	-	-	-	-	-	-	11	Rock (V)	
	699.2	EOB	20 50	-	100	SS-19	-	-	-	-	-	-	-	-	-	-	Rock (V)	

NOTES:
- Seepage was encountered at 25.5' during drilling.

NOTES: SEE ABOVE.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PLASTIC HOLE PLUG DEVICE; SOIL CUTTINGS MIXED WITH BENTONITE

S&ME ODOT LOG (8.5X11) - SGE 01/2019 - OH DOT.GDT - 6/28/24 15:06 - R:\SERVICE LINES\CS-2557\CLEVELAND\01 - LABORATORY\02 - GINT\WPROJECTS\22170059B-NEW.GPJ

PLATE 7

S&ME JOB: 22170059B

PROJECT: LAK-90-2.93 SLIDE	DRILLING FIRM / OPERATOR: OTB / J. MINCHAK	DRILL RIG: OTB ATV D50	STATION / OFFSET: 103+57, 136' LT	EXPLORATION ID B-002-0-22
TYPE: LANDSLIDE	SAMPLING FIRM / LOGGER: S&ME / S. SMITH	HAMMER: CME AUTOMATIC	ALIGNMENT: IR-90	
PID: 112663 BR ID: N/A	DRILLING METHOD: 3-1/4" HSA	CALIBRATION DATE: 12/22/22	ELEVATION: 770.1 (MSL) EOB: 77.0 ft.	PAGE 1 OF 3
START: 12/15/22 END: 12/15/22	SAMPLING METHOD: SPT	ENERGY RATIO (%): 79.1	LAT / LONG: 41.598022 N, 81.444005 W	

MATERIAL DESCRIPTION AND NOTES	ELEV. 770.1	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	HOLE SEALED
ASPHALT - 17 INCHES	768.7																	
GRANULAR BASE - 5 INCHES	768.2		3 4 5	12	94	SS-1A	-	-	-	-	-	-	-	-	-	-	Visual (V)	
FILL: Very-stiff to hard brown **SILT AND CLAY**, little fine to coarse sand, trace fine gravel, few stiff zones, damp.						SS-1B	4.0-4.5	-	-	-	-	-	-	-	-	17	A-6a (V)	
			3 3 4	9	39	SS-2	1.75-3.0	-	-	-	-	-	-	-	-	17	A-6a (V)	
			3 3 4	9	100	SS-3	1.5-4.5	6	5	9	39	41	32	19	13	17	A-6a (9)	
			3 4 5	12	100	SS-4A	3.0-4.5	-	-	-	-	-	-	-	-	15	A-6a (V)	
@ 6.7' to 7.5' medium stiff to stiff	762.6					SS-4B	0.5-1.5	-	-	-	-	-	-	-	-	16	A-6a (V)	
FILL: Medium-dense brown and gray **GRAVEL WITH SAND, SILT AND CLAY**, few very-stiff to hard silty clay zones, damp.			5 8 10	24	89	SS-5A	-	-	-	-	-	-	-	-	-	6	A-2-6 (V)	
						SS-5B	-	-	-	-	-	-	-	-	-	10	A-2-6 (V)	
	759.6		4 10 10	26	100	SS-6	-	-	-	-	-	-	-	-	-	8	A-2-6 (V)	
FILL: Very-stiff to hard brown and gray **SILT AND CLAY**, little to some fine to coarse gravel, trace to little fine to coarse sand, few stiff zones, few shale fragments, damp.		W 758.1	4 5 5	13	100	SS-7	4.5+	31	14	10	22	23	37	22	15	11	A-6a (4)	
			4 7 6	17	100	SS-8	-	-	-	-	-	-	-	-	-	12	A-6a (V)	
			2 4 4	11	100	SS-9	4.5+	17	6	7	36	34	37	22	15	13	A-6a (9)	
			2 3 4	9	67	SS-10	3.0-4.0	-	-	-	-	-	-	-	-	15	A-6a (V)	
		W 753.1	5 5 4	12	100	SS-11A	1.5-2.0	35	10	7	28	20	31	19	12	10	A-6a (3)	
	752.5					SS-11B	2.5-4.5	-	-	-	-	-	-	-	-	12	A-6a (V)	
FILL: Very-stiff to hard brown and gray **SILT AND CLAY**, little fine gravel, little fine to coarse sand, iron oxide staining, damp.			3 2 3	7	67	SS-12	3.0-4.5+	-	-	-	-	-	-	-	-	16	A-6a (V)	
	750.1		2 2 2	5	67	SS-13A	-	-	-	-	-	-	-	-	-	12	A-6a (V)	
FILL: Stiff to very-stiff dark brown and gray **SILTY CLAY**, little fine to coarse sand, little fine gravel, few hard zones, damp.						SS-13B	3.5-4.5	-	-	-	-	-	-	-	-	17	A-6b (V)	
			2 5 3	11	33	SS-14	1.25	17	10	8	30	35	36	20	16	17	A-6b (8)	
			2 5 3	11	89	SS-15	3.5-4.5	-	-	-	-	-	-	-	-	16	A-6b (V)	
	745.6		3 5 9	18	89	SS-16A	1.25	-	-	-	-	-	-	-	-	21	A-6b (V)	
FILL: Hard brown and gray **SILTY CLAY**, little fine to coarse sand, trace fine gravel, damp.						SS-16B	4.5+	-	-	-	-	-	-	-	-	16	A-6b (V)	
			1 6 9	20	67	SS-17	4.5+	3	5	8	40	44	33	17	16	14	A-6b (10)	
			5 7 9	21	67	SS-18	4.5+	-	-	-	-	-	-	-	-	14	A-6b (V)	
	740.4		4 7 12	25	100	SS-19A	2.5-4.5	-	-	-	-	-	-	-	-	15	A-6b (V)	

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PLATE 8

S&ME JOB: 22170059B

PID: 112663 | BR ID: N/A | PROJECT: LAK-90-2.93 SLIDE | STATION / OFFSET: 103+57, 136' LT | START: 12/15/22 | END: 12/15/22 | PG 2 OF 3 | **B-002-0-22**

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	HOLE SEALED
FILL: Medium-dense dark brown **GRAVEL WITH SAND, SILT, AND CLAY**, moist. *(continued)*	740.1 739.8	31	7 8 8	21	100	SS-19B	-	-	-	-	-	-	-	-	-	15	A-2-6 (V)	
						SS-20A	-	-	-	-	-	-	-	-	-	15	A-6a (V)	
						SS-20B	4.5+	-	-	-	-	-	-	-	-	13	A-6a (V)	
FILL: Very-stiff to hard brown **SILT AND CLAY**, little fine to coarse sand, trace fine gravel, damp.		32	4 6 8	18	100	SS-21	4.5+	4	6	11	37	42	32	19	13	14	A-6a (9)	
		33																
		34	6 10 13	30	100	SS-22	4.5+	-	-	-	-	-	-	-	-	16	A-6a (V)	
		35	7 8 9	22	100	SS-23	3.5-4.5	-	-	-	-	-	-	-	-	15	A-6a (V)	
	734.1	36																
FILL: Medium-dense gray **GRAVEL WITH SAND, SILT, AND CLAY**, damp.	733.9					SS-24A	-	-	-	-	-	-	-	-	-	14	A-2-6 (V)	
		37	5 6 8	18	100	SS-24B	3.5-4.5	6	6	10	37	41	34	18	16	15	A-6b (10)	
FILL: Very-stiff to hard brown **SILTY CLAY**, little fine to coarse sand, trace fine gravel, damp.		38	7 9 12	28	100	SS-25A	4.5+	-	-	-	-	-	-	-	-	15	A-6b (V)	
	731.4																	
FILL: Medium-dense brown and gray **GRAVEL WITH SAND, SILT, AND CLAY**, damp.	731.1	39				SS-25B	-	-	-	-	-	-	-	-	-	13	A-2-6 (V)	
			4 7 12	25	100	SS-26A	1.5-3.0	-	-	-	-	-	-	-	-	15	A-6a (V)	
		40				SS-26B	4.5+	-	-	-	-	-	-	-	-	18	A-6a (V)	
Very-stiff to hard brown and gray **SILT AND CLAY**, trace fine to coarse sand, trace fine gravel, few shale fragments, damp.		41	5 8 11	25	100	SS-27	4.5+	2	2	7	40	49	35	20	15	18	A-6a (10)	
		42	5 9 11	26	100	SS-28	2.5-4.5+	-	-	-	-	-	-	-	-	14	A-6a (V)	
	726.1	43																
Very-stiff to hard gray **SILTY CLAY**, little fine to coarse sand, little fine gravel, few shale fragments, iron oxide staining, damp.						SS-29A	3.5-4.5+	-	-	-	-	-	-	-	-	19	A-6a (V)	
		44	5 10 11	28	89	SS-29B	3.5-4.5+	-	-	-	-	-	-	-	-	19	A-6b (V)	
		45																
		46	4 7 8	20	78	SS-30	3.0-4.5	2	9	8	34	47	40	22	18	17	A-6b (11)	
	723.6																	
Hard gray **SILTY CLAY**, little fine to coarse sand, trace to little fine gravel, many shale fragments, similar to severely weathered shale, damp.		47	10 12 15	36	72	SS-31	4.5+	-	-	-	-	-	-	-	-	16	A-6b (V)	
		48																
		49	8 14 18	42	100	SS-32	4.5+	-	-	-	-	-	-	-	-	16	A-6b (V)	
		50	15 26 35	80	78	SS-33	4.5+	-	-	-	-	-	-	-	-	14	A-6b (V)	
	718.3																	
SHALE, gray, highly to severely weathered, very weak.		TR 52	21 50	-	100	SS-34A	4.5+	-	-	-	-	-	-	-	-	14	A-6b (V)	
						SS-34B	-	-	-	-	-	-	-	-	-	16	Rock (V)	
		53																
		54	37 34 27	80	100	SS-35	-	-	-	-	-	-	-	-	-	11	Rock (V)	
		55																
		56	18 50/4"	-	80	SS-36	-	-	-	-	-	-	-	-	-	13	Rock (V)	
		57																
		58																
		59	50	-	100	SS-37	-	-	-	-	-	-	-	-	-	11	Rock (V)	
		60																
		61	50/3"	-	67	SS-38	-	-	-	-	-	-	-	-	-	15	Rock (V)	

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PLATE 9

S&ME JOB: 22170059B

PID: 112663	BR ID: N/A	PROJECT: LAK-90-2.93 SLIDE	STATION / OFFSET: 103+57, 136' LT	START: 12/15/22	END: 12/15/22	PG 3 OF 3	**B-002-0-22**

MATERIAL DESCRIPTION AND NOTES	ELEV. 708.0	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	HOLE SEALED
SHALE, gray, highly to severely weathered, very weak. *(continued)*		63																
		64	50/2"	-	100	SS-39	-	-	-	-	-	-	-	-	-	4	Rock (V)	
	703.1	65																
		66																
		67																
SHALE, dark gray, slightly weathered, weak to slightly strong, thinly laminated to laminated, fissile, moderately to highly fractured, narrow to open, slightly rough, RQD = 77%, REC = 100%.		68																
		69	77		100	NQ-40											CORE	
		70																
		71																
		72																
		73																
@ 73.6' to 73.9' Q_u = 1,547 psi, γ_{dry} = 152.6 pcf		74	77		100	NQ-41											CORE	
		75																
		76																
	693.1	EOB 77																

NOTES:
- Seepage encountered at 12.0', 19.5' and 34.5' during drilling.
- Drilling was paused at a depth of 46' at the end of the day on 12/15/22. Before resuming drilling on 12/16/22, water was measured at a depth of 17.0'.

NOTES: SEE ABOVE.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: ASPHALT PATCH; BENTONITE AND CEMENT GROUT MIXTURE; PLASTIC HOLE PLUG DEVICE

PLATE 10

S&ME JOB: 22170059B

PROJECT: LAK-90-2.93 SLIDE	DRILLING FIRM / OPERATOR: OTB / J. MINCHAK	DRILL RIG: OTB ATV D50	STATION / OFFSET: 104+77, 280' LT	EXPLORATION ID B-003-0-22
TYPE: LANDSLIDE	SAMPLING FIRM / LOGGER: S&ME / S. SMITH	HAMMER: CME AUTOMATIC	ALIGNMENT: IR-90	
PID: 112663 BR ID: N/A	DRILLING METHOD: 3-1/4" HSA	CALIBRATION DATE: 12/22/22	ELEVATION: 717.3 (MSL) EOB: 32.5 ft.	PAGE 1 OF 2
START: 12/9/22 END: 12/9/22	SAMPLING METHOD: SPT	ENERGY RATIO (%): 79.1	LAT / LONG: 41.598520 N, 81.444209 W	

MATERIAL DESCRIPTION AND NOTES	ELEV. 717.3	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GR	CS	FS	SI	CL	LL	PL	PI	WC	ODOT CLASS (GI)	BACK FILL
TOPSOIL/ROOTMAT - 6 INCHES	716.8		2 3 6	12	100	SS-1A	-	-	-	-	-	-	-	-	-	-	Visual (V)	
FILL: Stiff to hard gray and brown **SILT AND CLAY**, little fine to coarse sand, trace fine gravel, damp.		1				SS-1B	1.25-2.5	-	-	-	-	-	-	-	-	17	A-6a (V)	
		2	5 7 8	20	94	SS-2	2.5-4.5	4	3	8	41	44	31	18	13	13	A-6a (9)	
	714.0	3				SS-3A	2.5	-	-	-	-	-	-	-	-	15	A-6a (V)	
FILL: Very-stiff to hard brown mottled with gray **SILT AND CLAY**, little fine to coarse sand, trace fine gravel, few shale fragments, damp.		4	5 6 8	18	100	SS-3B	4.5+	-	-	-	-	-	-	-	-	15	A-6a (V)	
		5	5 9 7	21	89	SS-4	4.5+	-	-	-	-	-	-	-	-	12	A-6a (V)	
		6	5 9 10	25	100	SS-5	4.5+	5	5	9	42	39	28	15	13	2	A-6a (9)	
		7	6 7 10	22	89	SS-6	4.5+	-	-	-	-	-	-	-	-	13	A-6a (V)	
		8	4 7 8	20	100	SS-7	4.5+	-	-	-	-	-	-	-	-	13	A-6a (V)	
		9	5 7 11	24	100	SS-8	3.5-4.5	-	-	-	-	-	-	-	-	14	A-6a (V)	
@ 12.0' to 13.5' "and" fine to coarse gravel		10	6 9 6	20	100	SS-9	3.0-4.5	35	9	8	24	24	31	20	11	10	A-6a (3)	
		11	4 6 8	18	89	SS-10	3.0-4.5	-	-	-	-	-	-	-	-	15	A-6a (V)	
		12	5 6 6	16	89	SS-11	3.0-4.5	-	-	-	-	-	-	-	-	12	A-6a (V)	
		13	4 7 9	21	89	SS-12A	4.5	6	7	12	37	38	33	19	14	15	A-6a (10)	
	699.3					SS-12B	3.0	-	-	-	-	-	-	-	-	17	A-6a (V)	
Stiff gray **SILT AND CLAY**, little fine to coarse sand, trace fine gravel, few wood fragments, organic odor, possible buried topsoil, damp.		14	3 5 5	13	100	SS-13	1.25-1.5	4	5	6	42	43	40	25	15	27	A-6a (10)	
	696.7	15	3 3 7	13	100	SS-14A	1.0-1.5	-	-	-	-	-	-	-	-	43	A-6a (V)	
Very-stiff to hard gray mottled brown **CLAY**, some silt, little fine to coarse sand, little fine gravel, iron oxide staining, damp.		16				SS-14B	4.5+	-	-	-	-	-	-	-	-	20	A-7-6 (V)	
		17	4 6 12	24	94	SS-15	2.5-3.5	-	-	-	-	-	-	-	-	21	A-7-6 (V)	
		18	5 8 5	17	100	SS-16	3.5-4.5	14	8	11	34	33	45	25	20	20	A-7-6 (11)	
@ 24.0' becoming stiff to very-stiff		19	3 4 6	13	100	SS-17	1.5-2.0	-	-	-	-	-	-	-	-	22	A-7-6 (V)	
	690.3	20	2 3 6	12	61	SS-18	1.5-2.0	-	-	-	-	-	-	-	-	19	A-7-6 (V)	
	689.8	W 690.1	4 4 7	15	67	SS-19A	2.5	23	2	2	38	35	26	16	10	15	A-4a (8)	
Very-stiff gray **SANDY SILT**, some clay, some fine gravel, moist.		21				SS-19B	2.0	-	-	-	-	-	-	-	-	17	A-6b (V)	
Very-stiff to hard gray **SILTY CLAY**, little fine to coarse sand, trace to little fine to coarse gravel, many shale fragments, damp.	687.3	22	8 10 15	33	100	SS-20	4.5	-	-	-	-	-	-	-	-	11	A-6b (V)	

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PLATE 11

S&ME JOB: 22170059B

PID: 112663	BR ID: N/A	PROJECT: LAK-90-2.93 SLIDE	STATION / OFFSET: 104+77, 280' LT	START: 12/9/22	END: 12/9/22	PG 2 OF 2	**B-003-0-22**

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	BACK FILL
SHALE, gray, highly to severely weathered, very weak.	687.3	TR	11 22 46	90	78	SS-21	-	-	-	-	-	-	-	-	-	7	Rock (V)	
	684.8	W 685.0 EOB	29 50	-	100	SS-22	-	-	-	-	-	-	-	-	-	10	Rock (V)	

NOTES:
- Seepage encountered at 27.2' and 32.3' during drilling.

NOTES: SEE ABOVE.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PLASTIC HOLE PLUG DEVICE; SOIL CUTTINGS MIXED WITH BENTONITE

PLATE 12

S&ME JOB: 22170059B

PROJECT: LAK-90-2.93 SLIDE	DRILLING FIRM / OPERATOR: OTB / J. MINCHAK	DRILL RIG: OTB ATV D50	STATION / OFFSET: 106+79, 301' LT	EXPLORATION ID B-004-0-22
TYPE: LANDSLIDE	SAMPLING FIRM / LOGGER: S&ME / S. SMITH	HAMMER: CME AUTOMATIC	ALIGNMENT: IR-90	
PID: 112663 BR ID: N/A	DRILLING METHOD: 3-1/4" HSA	CALIBRATION DATE: 12/22/22	ELEVATION: 710.4 (MSL) EOB: 36.8 ft.	PAGE 1 OF 2
START: 12/9/22 END: 12/13/22	SAMPLING METHOD: SPT / ST	ENERGY RATIO (%): 79.1	LAT / LONG: 41.599033 N, 81.443850 W	

MATERIAL DESCRIPTION AND NOTES	ELEV. 710.4	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	BACK FILL
TOPSOIL/ROOTMAT - 6 INCHES	709.9		1			SS-1A	-	-	-	-	-	-	-	-	-	-	Visual (V)	
FILL: Very-stiff to hard brown and gray **SILT AND CLAY**, little fine to coarse sand, trace fine gravel, damp.		1	5 3	11	67	SS-1B	4.5+	-	-	-	-	-	-	-	-	16	A-6a (V)	
		2	3 8 9	22	89	SS-2	4.5+	3	3	8	42	44	31	17	14	13	A-6a (10)	
		3	5 8 8	21	72	SS-3	4.5+	-	-	-	-	-	-	-	-	13	A-6a (V)	
		4	5 8 7	20	100	SS-4	4.5+	-	-	-	-	-	-	-	-	13	A-6a (V)	
		5	5 6 6	16	100	SS-5	3.5-4.5+	4	5	10	40	41	29	16	13	13	A-6a (9)	
		6	4 5 7	16	94	SS-6	2.5-4.5+	-	-	-	-	-	-	-	-	14	A-6a (V)	
	700.3	7	4 8 7	20	100	SS-7A	4.5+	-	-	-	-	-	-	-	-	12	A-6a (V)	
						SS-7B	4.5+	-	-	-	-	-	-	-	-	14	A-6a (V)	
FILL: Hard brown and dark brown **SILT AND CLAY**, little fine to coarse sand, little fine gravel, damp.	698.4	8	5 6 9	20	100	SS-8	4.5+	16	7	9	35	33	29	17	12	11	A-6a (7)	
FILL: Medium-dense gray **GRAVEL WITH SAND AND SILT**, little clay, many shale fragments, damp.	697.8	9	9 7 8	20	100	SS-9A	-	-	-	-	-	-	-	-	-	5	A-2-4 (V)	
						SS-9B	4.5+	-	-	-	-	-	-	-	-	15	A-6a (V)	
FILL: Hard brown **SILT AND CLAY**, little fine to coarse sand, trace fine to coarse gravel, dry to damp.		10	5 7 7	18	67	SS-10	4.5+	9	7	10	39	35	30	17	13	13	A-6a (9)	
	693.4	11	5 6 7	17	72	SS-11	4.5+	-	-	-	-	-	-	-	-	3	A-6a (V)	
Stiff to very-stiff dark gray mottled with dark brown **SILT AND CLAY**, little fine to coarse sand, trace fine gravel, few hard zones, damp.		12	5 4 4	11	89	SS-12A	4.5+	-	-	-	-	-	-	-	-	8	A-6a (V)	
						SS-12B	2.0-2.5	-	-	-	-	-	-	-	-	15	A-6a (V)	
		13	3 3 3	8	67	SS-13	3.0-4.5	-	-	-	-	-	-	-	-	15	A-6a (V)	
		14	2 2 3	7	67	SS-14	1.5-2.0	-	-	-	-	-	-	-	-	2	A-6a (V)	
	687.4	15			50	ST-15	3.5-4.0	7	7	12	40	34	30	17	13	16	A-6a (9)	
Very-stiff gray **SANDY SILT**, some clay, trace to little fine gravel, damp.	686.9	16	7 4 5	12	100	SS-16A	2.5	-	-	-	-	-	-	-	-	17	A-4a (V)	
						SS-16B	1.75-2.5	-	-	-	-	-	-	-	-	28	A-6a (V)	
Stiff to very-stiff dark gray to black **SILT AND CLAY**, trace fine to coarse sand, slightly organic, few wood fragments, possible buried topsoil, damp. @ 24.5' to 25.9' LOI = 3.2%		17	2 3 4	9	94	SS-17	1.5-2.0	0	0	6	52	42	38	23	15	23	A-6a (10)	
		18	2 3 4	9	100	SS-18	1.5-2.0	-	-	-	-	-	-	-	-	23	A-6a (V)	
	682.6	W 682.6				SS-19A	1.5	-	-	-	-	-	-	-	-	24	A-6a (V)	
Loose to medium-dense gray **GRAVEL WITH SAND AND SILT**, trace clay, damp to moist.		19	2 2 4	8	72	SS-19B	-	-	-	-	-	-	-	-	-	10	A-2-4 (V)	
		20	5 5	13	67	SS-20	-	38	33	13	11	5	-	-	-	13	A-2-4 (V)	

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PLATE 13

S&ME JOB: 22170059B

PID: 112663	BR ID: N/A	PROJECT: LAK-90-2.93 SLIDE	STATION / OFFSET: 106+79, 301' LT	START: 12/9/22	END: 12/13/22	PG 2 OF 2	**B-004-0-22**

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	BACK FILL
Loose to medium-dense gray **GRAVEL WITH SAND AND SILT**, trace clay, damp to moist. *(continued)*	680.4	31	5															
		32	1 2 4	8	67	SS-21	-	-	-	-	-	-	-	-	-	14	A-2-4 (V)	
		33	4 4 6	13	67	SS-22	-	-	-	-	-	-	-	-	-	19	A-2-4 (V)	
		34	5 5 4	12	61	SS-23	-	-	-	-	-	-	-	-	-	13	A-2-4 (V)	
	674.7	35	6 6 29	46	72	SS-24A	-	-	-	-	-	-	-	-	-	11	A-2-4 (V)	
SHALE, gray, highly to severely weathered, very weak.	673.6	36 TR EOB				SS-24B	-	-	-	-	-	-	-	-	-	11	Rock (V)	
			50/4"	-	100	SS-25	-	-	-	-	-	-	-	-	-	9	Rock (V)	

NOTES:
- Encountered groundwater at 27.8' during drilling.
- Encountered heaving sand at 30.5'. Added water to boring at 32.0' to counter heave.

NOTES: SEE ABOVE.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PLASTIC HOLE PLUG DEVICE; SOIL CUTTINGS MIXED WITH BENTONITE

PLATE 14

S&ME JOB: 22170059B

PROJECT: LAK-90-2.93 SLIDE	DRILLING FIRM / OPERATOR: OTB / J. MINCHAK	DRILL RIG: OTB ATV D50	STATION / OFFSET: 108+48, 274' LT	EXPLORATION ID B-005-0-22
TYPE: LANDSLIDE	SAMPLING FIRM / LOGGER: S&ME / S. SMITH	HAMMER: CME AUTOMATIC	ALIGNMENT: IR-90	
PID: 112663 BR ID: N/A	DRILLING METHOD: 3-1/4" HSA	CALIBRATION DATE: 12/22/22	ELEVATION: 707.8 (MSL) EOB: 34.9 ft.	PAGE 1 OF 2
START: 12/13/22 END: 12/14/22	SAMPLING METHOD: SPT	ENERGY RATIO (%): 79.1	LAT / LONG: 41.599384 N, 81.443402 W	

MATERIAL DESCRIPTION AND NOTES	ELEV. 707.8	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GR	CS	FS	SI	CL	LL	PL	PI	WC	ODOT CLASS (GI)	MON. WELL
TOPSOIL/ROOTMAT - 4 INCHES	707.5		1			SS-1A	-	-	-	-	-	-	-	-	-	-	Visual (V)	
FILL: Stiff to very-stiff brown and gray **SILT AND CLAY**, little fine to coarse sand, little fine gravel, few hard zones, few roots, damp.			1 2	4	78	SS-1B	1.0-2.0	-	-	-	-	-	-	-	-	18	A-6a (V)	
			2 2 3	7	78	SS-2	1.0-2.5	11	5	9	36	39	34	19	15	17	A-6a (10)	
@ SS-3 dry.			2 3 4	9	72	SS-3	1.0-3.5	-	-	-	-	-	-	-	-	2	A-6a (V)	
	701.8		2 3 4	9	78	SS-4	1.5-4.5+	-	-	-	-	-	-	-	-	19	A-6a (V)	
FILL: Stiff to hard brown **SILT AND CLAY**, little fine to coarse sand, trace fine gravel, damp.			4 4 3	9	100	SS-5	1.5-2.5	9	5	8	38	40	32	18	14	16	A-6a (10)	
			2 3 2	7	39	SS-6	3.5-4.5	-	-	-	-	-	-	-	-	15	A-6a (V)	
			1 3 4	9	100	SS-7	1.0-3.5	-	-	-	-	-	-	-	-	18	A-6a (V)	
			2 4 7	15	67	SS-8	4.5+	-	-	-	-	-	-	-	-	14	A-6a (V)	
	695.3		3 5 7	16	100	SS-9A	2.5	-	-	-	-	-	-	-	-	14	A-6a (V)	
						SS-9B	4.5	21	5	8	35	31	31	18	13	12	A-6a (7)	
FILL: Very-stiff to hard brown and gray, **SILT AND CLAY**, some fine to coarse gravel, little fine to coarse sand, damp.	692.8		3 6 8	18	72	SS-10	2.5-4.5	-	-	-	-	-	-	-	-	15	A-6a (V)	
FILL: Very-stiff to hard brown **SILT AND CLAY**, little fine to coarse sand, trace fine gravel, damp.			6 6 9	20	94	SS-11	3.5-4.5	10	6	10	38	36	33	19	14	15	A-6a (9)	
@ 16.5' to 17.1 black, few wood fragments.	690.7		3 3 5	11	100	SS-12A	2.5-3.5	-	-	-	-	-	-	-	-	16	A-6a (V)	
FILL: Medium-stiff to very-stiff brown **SILTY CLAY**, little fine to coarse sand, trace fine gravel, few roots, moist.	689.1					SS-12B	0.5-1.5	2	4	10	36	48	39	21	18	22	A-6b (11)	
			2 4 5	12	72	SS-13A	2.0-3.0	-	-	-	-	-	-	-	-	11	A-6b (V)	
						SS-13B	2.5-4.5+	-	-	-	-	-	-	-	-	18	A-6a (V)	
FILL: Stiff to hard gray **SILT AND CLAY**, little fine to coarse sand, trace fine gravel, iron oxide staining, damp.	686.8		3 4 6	13	100	SS-14	1.25-4.5	10	7	7	42	34	35	20	15	17	A-6a (10)	
FILL: Stiff to very-stiff brown and gray **SILT AND CLAY**, some fine to coarse sand, trace fine gravel, few roots and coal fragments, few hard zones, moist.			3 5 8	17	100	SS-15	2.5-4.5	-	-	-	-	-	-	-	-	20	A-6a (V)	
		▼ 67 days (W 683.4)	3 4 5	12	100	SS-16A	2.5	-	-	-	-	-	-	-	-	22	A-6a (V)	
	683.8					SS-16B	1.25-1.75	10	12	15	38	25	33	21	12	21	A-6a (6)	
Medium-stiff brown and gray **SANDY SILT**, some clay, little fine to coarse gravel, few shale fragments, moist to wet.	682.3		3 5 6	15	28	SS-17	0.5-1.0	-	-	-	-	-	-	-	-	20	A-4a (V)	
Medium-dense gray **GRAVEL WITH SAND**, little silt, trace clay, few pockets of silty clay, damp to moist.		▼ 16 days	3 5 6	15	67	SS-18	-	35	34	12	13	6	21	18	3	16	A-1-b (0)	
		▼ 114 days	7 7 7	18	56	SS-19	-	-	-	-	-	-	-	-	-	10	A-1-b (V)	
			6 6 8	18	56	SS-20A	-	-	-	-	-	-	-	-	-	11	A-1-b (V)	
						SS-20B	-	-	-	-	-	-	-	-	-	13	A-1-b (V)	

S&ME ODOT LOG (8.5X11) - SGE 01/2019 - OH DOT.GDT - 6/28/24 15:06 - R:\SERVICE LINES\CS-2557\CLEVELAND\01 - LABORATORY\02 - GINT\PROJECTS\22170059B-NEW.GPJ

PLATE 15

S&ME JOB: 22170059B

PID: 112663	BR ID: N/A	PROJECT: LAK-90-2.93 SLIDE	STATION / OFFSET: 108+48, 274' LT	START: 12/13/22	END: 12/14/22	PG 2 OF 2	**B-005-0-22**

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	MON. WELL
Medium-dense gray **GRAVEL WITH SAND**, little silt, trace clay, few pockets of silty clay, damp to moist. *(continued)*	677.8	31	4 6 6	16	78	SS-21	-	-	-	-	-	-	-	-	-	11	A-1-b (V)	
	675.9	32	15 14 15	38	56	SS-22A	-	-	-	-	-	-	-	-	-	13	A-1-b (V)	
Very-stiff gray **SILT AND CLAY**, some fine gravel, some fine to coarse sand, damp.	674.8	TR 33				SS-22B	2.5	33	13	13	25	16	30	19	11	14	A-6a (1)	
SHALE, gray, highly to severely weathered, very weak.		34	14 50/5"	-	100	SS-23	-	-	-	-	-	-	-	-	-	16	Rock (V)	
	672.9	EOB	50/5"	-	100	SS-24	-	-	-	-	-	-	-	-	-	9	Rock (V)	

NOTES:
- Sepage was encountered at 23.8' during drilling.
- Groundwater encountered at 24.2' during drilling.
- Added water inside augers at 25.5' to facilitate drilling.
- Installed groundwater monitoring well to 34.5' with the screened interval from 24.5' to 34.5'.

NOTES: SEE ABOVE.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: BENTONITE CHIPS; MONITORING WELL; SAND; SOIL CUTTINGS

PLATE 16

S&ME JOB: 22170059B

PROJECT: LAK-90-2.93 SLIDE	DRILLING FIRM / OPERATOR: ADC / A. UNVERZAGT	DRILL RIG: ADC CME 550X ATV	STATION / OFFSET: 108+15, 277' LT
TYPE: LANDSLIDE	SAMPLING FIRM / LOGGER: S&ME / S. SMITH	HAMMER: CME AUTOMATIC	ALIGNMENT: IR-90
PID: 112663 BR ID: N/A	DRILLING METHOD: 4.25" HSA	CALIBRATION DATE: 4/28/23	ELEVATION: 707.2 (MSL) EOB: 64.4 ft.
START: 5/13/24 END: 5/14/24	SAMPLING METHOD: SPT / ST	ENERGY RATIO (%): 85	LAT / LONG: 41.599305 N, 81.443817 W

EXPLORATION ID **B-005-1-23**

PAGE 1 OF 3

MATERIAL DESCRIPTION AND NOTES	ELEV. 707.2	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	HOLE SEALED
Augered to 38.5 feet without split spoon sampling. See B-005-0-22 for stratigraphy.																		
@ 4.0' to 6.0' Q_u = 2,079 psf, γ_{dry} = 111.6 pcf					58	ST-1	1.3-2.0	-	-	-	-	-	-	-	-	19	A-6a (V)	

690.7

680.7

PLATE 17

S&ME JOB: 22170059B

PID: 112663	BR ID: N/A	PROJECT: LAK-90-2.93 SLIDE	STATION / OFFSET: 108+15, 277' LT	START: 5/13/24	END: 5/14/24	PG 2 OF 3	**B-005-1-23**

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	HOLE SEALED
Augered to 38.5 feet without split spoon sampling. See B-005-0-22 for stratigraphy. *(continued)*	677.2	31 32 33 34																
	672.2	TR 35																
SHALE, gray, highly to severely weathered.		36 37 38																
		39	24 50/3"	-	89	SS-2	-	-	-	-	-	-	-	-	-	-	Rock (V)	
		40 41																
		42	18 50 42	130	100	SS-3	2.5-3.0	-	-	-	-	-	-	-	-	-	Rock (V)	
		43																
	663.0	44	32 50/1"	-	100	SS-4	-	-	-	-	-	-	-	-	-	-	Rock (V)	
SHALE, gray, slightly to moderately weathered, weak to slightly strong, laminated to thinly laminated, highly to moderately fractured, narrow, slightly rough, blocky/seamy/disturbed structure, fair to good surface condition, RQD = 59%, REC = 91%. @ 44.2' to 49.2' SDI = 74.8% @ 46.4' to 46.8' Q_u = 1,327 psi, γ_{dry} = 154.3 pcf		45 46 47 48 49	52		73	NQ-5											CORE	
@ 49.8' to 52.2'; severely to highly weathered		50 51 52 53 54	75		100	NQ-6											CORE	
		55 56 57 58 59	34		100	NQ-7											CORE	
@ 60.8' to 61.2' Q_u = 1,554 psi, γ_{dry} = 154.9 pcf		60 61	75		90	NQ-8											CORE	

S&ME JOB: 22170059B

PID: 112663	BR ID: N/A	PROJECT: LAK-90-2.93 SLIDE	STATION / OFFSET: 108+15, 277' LT	START: 5/13/24	END: 5/14/24	PG 3 OF 3	**B-005-1-23**

MATERIAL DESCRIPTION AND NOTES	ELEV. 645.1	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	HOLE SEALED
- SEE DESCRIPTION ON PREVIOUS PAGE -	642.8	63 64 EOB																

NOTES:
- Groundwater measured at 26.5' in the augers after drilling stopped on 5/13/24.
- Groundwater measured in the augers at 16.5' before continuing drilling and at 23.0' before rock coring on 5/14/24.
- Boring caved at 30.0' and water was measured at 20.0' after removing augers.

NOTES: SEE ABOVE.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: BENTONITE AND CEMENT GROUT MIXTURE

S&ME JOB: 22170059B

PROJECT: LAK-90-2.93 SLIDE	DRILLING FIRM / OPERATOR: OTB / D. HEPNER	DRILL RIG: OTB ATV D50	STATION / OFFSET: 110+36, 254' LT
TYPE: LANDSLIDE	SAMPLING FIRM / LOGGER: S&ME / S. SMITH	HAMMER: CME AUTOMATIC	ALIGNMENT: IR-90
PID: 112663 BR ID: N/A	DRILLING METHOD: 3-1/4" HSA	CALIBRATION DATE: 12/22/22	ELEVATION: 709.2 (MSL) EOB: 36.0 ft.
START: 7/18/23 END: 7/19/23	SAMPLING METHOD: SPT / ST	ENERGY RATIO (%): 79.1	LAT / LONG: 41.599691 N, 81.443333 W

EXPLORATION ID **B-007-0-22**

PAGE 1 OF 2

MATERIAL DESCRIPTION AND NOTES	ELEV. 709.2	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	BACK FILL
FILL: Very-stiff to hard brown to gray **SILT AND CLAY**, little fine to coarse sand, trace fine to coarse gravel, few roots and shale fragments, few stiff zones, damp to moist.			2 2 3	7	67	SS-1	1.75-4.0	10	6	10	34	40	34	19	15	18	A-6a (10)	
			3 5 8	17	61	SS-2	2.7-3.5	-	-	-	-	-	-	-	-	21	A-6a (V)	
			3 5 5	13	89	SS-3A	3.5-4.5+	-	-	-	-	-	-	-	-	13	A-6a (V)	
						SS-3B	3.0-4.5+	27	13	10	27	23	35	20	15	10	A-6a (5)	
			3 4 6	13	61	SS-4A	2.5-3.0	-	-	-	-	-	-	-	-	20	A-6a (V)	
						SS-4B	4.5+	-	-	-	-	-	-	-	-	14	A-6a (V)	
			5 6 8	18	89	SS-5	3.0-4.5+	3	7	11	41	38	30	17	13	14	A-6a (9)	
@ 8.0' to 9.0' LOI = 3.1%, slightly organic			2 4 3	9	89	SS-6A	3.0-4.5	-	-	-	-	-	-	-	-	15	A-6a (V)	
						SS-6B	1.0-3.5	-	-	-	-	-	-	-	-	23	A-6a (V)	
@ 9.0' to 11.0' Q_u = 7,956 psf, γ_{dry} = 119.4 pcf					73	ST-7	3.8-4.5+	4	5	10	40	41	34	19	15	16	A-6a (10)	
			5 6 9	20	78	SS-8	4.5+	-	-	-	-	-	-	-	-	14	A-6a (V)	
			2 4 5	12	56	SS-9	3.0-4.0	-	-	-	-	-	-	-	-	18	A-6a (V)	
			4 6 8	18	72	SS-10	4.5+	-	-	-	-	-	-	-	-	17	A-6a (V)	
			3 5 5	13	89	SS-11	2.7-4.0	-	-	-	-	-	-	-	-	16	A-6a (V)	
	691.8																	
FILL: Stiff to hard brown to dark brown and gray **SILTY CLAY**, little fine to coarse sand, trace fine gravel, damp to moist.			3 3 5	11	61	SS-12A	3.0-4.0	-	-	-	-	-	-	-	-	18	A-6a (V)	
						SS-12B	1.0-1.5	-	-	-	-	-	-	-	-	17	A-6b (V)	
@ 18.5' to 20.5' Q_u = 5,268 psf, γ_{dry} = 114.2 pcf					70	ST-13	1.7-4.5+	3	4	10	41	42	36	19	17	18	A-6b (11)	
@ 20.5' encountered cobbles			5 6 10	21	100	SS-14	2.5-4.5	-	-	-	-	-	-	-	-	19	A-6b (V)	
	686.7	W 686.7																
POSSIBLE FILL: Stiff to very-stiff gray **SILT AND CLAY**, little fine gravel (shale fragments), trace fine to coarse sand, slight organic odor (SS-15B), few hard zones, damp to moist.			4 6 8	18	67	SS-15A	3.5-4.5	-	-	-	-	-	-	-	-	16	A-6b (V)	
						SS-15B	1.5-2.5	-	-	-	-	-	-	-	-	17	A-6a (V)	
						SS-16A	1.0-1.5	-	-	-	-	-	-	-	-	19	A-6a (V)	
			8 24 9	44	89	SS-16B	3.5	14	5	5	48	28	33	21	12	12	A-6a (9)	
	683.8	W 683.7																
Medium-dense to dense gray **GRAVEL WITH SAND**, trace silt, trace clay, many shale and sandstone fragments, damp to wet.			4 9 18	36	56	SS-17A	4.5	-	-	-	-	-	-	-	-	13	A-6a (V)	
						SS-17B	-	-	-	-	-	-	-	-	-	10	A-1-b (V)	
@ 26.0' encountered cobbles			3 6 8	18	100	SS-18	-	34	32	21	9	4	NP	NP	NP	16	A-1-b (0)	
			6 7 9	21	61	SS-19	-	-	-	-	-	-	-	-	-	13	A-1-b (V)	
	679.4																	
			5			SS-20A	-	-	-	-	-	-	-	-	-	12	A-1-b (V)	

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PLATE 20

S&ME JOB: 22170059B

PID: 112663	BR ID: N/A	PROJECT: LAK-90-2.93 SLIDE	STATION / OFFSET: 110+36, 254' LT	START: 7/18/23	END: 7/19/23	PG 2 OF 2	**B-007-0-22**

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	BACK FILL
Loose to medium-dense gray **COARSE AND FINE SAND**, some silt, trace clay, trace fine gravel, wet. *(continued)*	679.2	31	2 5	9	100	SS-20B	-	2	1	68	24	5	NP	NP	NP	26	A-3a (0)	
	677.6		3 7 9	21	72	SS-21A	-	-	-	-	-	-	-	-	-	23	A-3a (V)	
Medium-dense to dense gray **GRAVEL WITH SAND**, trace to little silt, trace clay, wet.		32				SS-21B	-	-	-	-	-	-	-	-	-	14	A-1-b (V)	
		33	6 8 16	32	61	SS-22A	-	-	-	-	-	-	-	-	-	13	A-1-b (V)	
	675.2					SS-22B	-	-	-	-	-	-	-	-	-	12	A-1-b (V)	
		TR 34	14 50/5"	-	100	SS-23	-	-	-	-	-	-	-	-	-	10	Rock (V)	
SHALE, gray, highly to severely weathered, very weak to weak.		35																
	673.2	EOB 36	50	-	100	SS-24	-	-	-	-	-	-	-	-	-	10	Rock (V)	

NOTES:
- Slope benching removed approximately 4' at cut edge. Elevation on log is at original ground surface.
- Seepage encountered at 22.5' during drilling.
- Groundwater encountered at 25.8' during drilling.
- Water measured inside hollow-stem augers at 30' prior to removing augers.
- Boring caved at 17.0' and was dry.
- Encountered cobbles at 20.5' and 26.0'.

NOTES: SEE ABOVE.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PLASTIC HOLE PLUG DEVICE; SOIL CUTTINGS MIXED WITH BENTONITE

PLATE 21

S&ME JOB: 22170059B

PROJECT: LAK-90-2.93 SLIDE	DRILLING FIRM / OPERATOR: ADC / A. UNVERZAGT	DRILL RIG: ADC CME 550X ATV	STATION / OFFSET: 110+08, 234' LT
TYPE: LANDSLIDE	SAMPLING FIRM / LOGGER: S&ME / S. SMITH	HAMMER: CME AUTOMATIC	ALIGNMENT: IR-90
PID: 112663 BR ID: N/A	DRILLING METHOD: 4.25" HSA	CALIBRATION DATE: 4/28/23	ELEVATION: 716.4 (MSL) EOB: 65.9 ft.
START: 5/14/24 END: 5/15/24	SAMPLING METHOD: SPT / ST	ENERGY RATIO (%): 85	LAT / LONG: 41.599595 N, 81.443340 W

EXPLORATION ID **B-007-3-23**

PAGE 1 OF 3

MATERIAL DESCRIPTION AND NOTES	ELEV. 716.4	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	HOLE SEALED
Augered to 41.0 feet without split spoon sampling. See B-007-0-22 for stratigraphy.																		
@ 8.0' to 10.0' Q_u = 6,379 psf, γ_{dry} = 114.4 pcf					88	ST-1	2.5-4.5	-	-	-	-	-	-	-	-	17	A-6a (V)	

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29

▼ 22

PLATE 22

S&ME JOB: 22170059B

PID: 112663 | BR ID: N/A | PROJECT: LAK-90-2.93 SLIDE | STATION / OFFSET: 110+08, 234' LT | START: 5/14/24 | END: 5/15/24 | PG 2 OF 3 | **B-007-3-23**

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	HOLE SEALED
Augered to 41.0 feet without split spoon sampling. See B-007-0-22 for stratigraphy. *(continued)*	686.4	W 684.4																
SHALE, gray, severely to highly weathered, very weak to weak.	675.9	TR	15 50/3"	-	100	SS-2	-	-	-	-	-	-	-	-	-	-	Rock (V)	
			12 50/2"	-	125	SS-3	-	-	-	-	-	-	-	-	-	-	Rock (V)	
SHALE, gray, severely to highly weathered, very weak, laminated to thinly laminated, highly to moderately fractured, narrow to open, slightly rough, friable, fissile, few clay seams, laminated/sheared structure, poor to very poor surface, RQD = 49%, REC = 97%. @ 46.9' to 47.3' Q_u = 167 psi, γ_{dry} = 138.0 pcf	671.4		30		88	NQ-4											CORE	
			66		100	NQ-5											CORE	
			55		100	NQ-6											CORE	
@ 59.6' to 60.0' Q_u = 78 psi, γ_{dry} = 134.6 pcf																		

S&ME ODOT LOG (8.5X11) - SGE 01/2019 - OH DOT.GDT - 6/28/24 15:06 - R:\SERVICE LINES\CS-2557\CLEVELAND\01 - LABORATORY\02 - GINTW\PROJECTS\22170059B-NEW.GPJ

PLATE 23

S&ME JOB: 22170059B

PID: 112663	BR ID: N/A	PROJECT: LAK-90-2.93 SLIDE	STATION / OFFSET: 110+08, 234' LT	START: 5/14/24	END: 5/15/24	PG 3 OF 3	**B-007-3-23**

MATERIAL DESCRIPTION AND NOTES	ELEV. 654.3	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	HOLE SEALED
SHALE, gray, slightly weathered, weak to slightly strong, laminated to thinly laminated, moderately fractured, narrow, slightly rough, blocky/seamy/disturbed structure, fair to good surface, RQD = 86%, REC = 100%.	654.0	63 64 65	68		100	NQ-7											CORE	
	650.5	EOB																

NOTES:
- Seepage observed at 14.0'.
- Groundwater not observed inside augers after drilling stopped on 5/14/24.
- Groundwater measured in the augers at 32.0' before continuing drilling, prior to rock coring on 5/15/24.
- Boring caved at 34.3' and water was measured at 22.0' after removing augers.

NOTES: SEE ABOVE.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: BENTONITE AND CEMENT GROUT MIXTURE

S&ME JOB: 22170059B

PROJECT: LAK-90-2.93 SLIDE	DRILLING FIRM / OPERATOR: ADC / A. UNVERZAGT	DRILL RIG: ADC CME 550X ATV	STATION / OFFSET: 111+20, 223' LT
TYPE: LANDSLIDE	SAMPLING FIRM / LOGGER: S&ME / S. SMITH	HAMMER: CME AUTOMATIC	ALIGNMENT: IR-90
PID: 112663 BR ID: N/A	DRILLING METHOD: 4.25" HSA	CALIBRATION DATE: 4/28/23	ELEVATION: 721.0 (MSL) EOB: 69.2 ft.
START: 5/16/24 END: 5/16/24	SAMPLING METHOD: SPT / ST	ENERGY RATIO (%): 85	LAT / LONG: 41.599829 N, 81.443053 W

EXPLORATION ID **B-007-4-23**

MATERIAL DESCRIPTION AND NOTES	ELEV. 721.0	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	HOLE SEALED
FILL: Very-stiff to hard brown, dark brown and gray **SILT AND CLAY**, little fine to coarse sand, trace fine gravel, few stiff zones, occassional iron oxide staining, few shale and sandstone fragments, damp to moist.		1	3 4 4	11	78	SS-1	2.2-3.5	-	-	-	-	-	-	-	-	20	A-6a (V)	
		2																
		3																
		4	1 2 5	10	89	SS-2	1.5-2.8	7	6	9	39	39	33	19	14	17	A-6a (10)	
		5																
		6	2 3 5	11	94	SS-3A	1.5-2.5	-	-	-	-	-	-	-	-	29	A-6a (V)	
		7				SS-3B	3.5-4.5	-	-	-	-	-	-	-	-	13	A-6a (V)	
		8																
		9	1 3 5	11	100	SS-4	2.5-4.5+	-	-	-	-	-	-	-	-	16	A-6a (V)	
		10																
		11			71	ST-5	-	9	6	7	35	43	35	20	15	18	A-6a (10)	
		12																
		13																
		14	7 8 8	23	6	SS-6	3.5	-	-	-	-	-	-	-	-	13	A-6a (V)	
		15																
		16	6 6 7	18	100	SS-7	2.2-3.5	-	-	-	-	-	-	-	-	18	A-6a (V)	
		17																
		18																
		19	3 6 7	18	100	SS-8	3.5-4.0	-	-	-	-	-	-	-	-	13	A-6a (V)	
		20																
		21																
		22	3 5 10	21	100	SS-9	2.5-4.5	-	-	-	-	-	-	-	-	16	A-6a (V)	
		23																
		24	3 7 10	24	100	SS-10	4.5+	6	7	11	39	37	30	17	13	13	A-6a (9)	
		25																
		26																
		27	6 9 13	31	100	SS-11	4.0-4.5	-	-	-	-	-	-	-	-	16	A-6a (V)	
@ 27.2' - 27.3', silty sand seam		28																
		29																
			3 5 8	18	100	SS-12	2.5-4.0	-	-	-	-	-	-	-	-	20	A-6a (V)	

S&ME JOB: 22170059B

PID: 112663	BR ID: N/A	PROJECT: LAK-90-2.93 SLIDE	STATION / OFFSET: 111+20, 223' LT	START: 5/16/24	END: 5/16/24	PG 2 OF 3	**B-007-4-23**

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	HOLE SEALED
FILL: Very-stiff to hard brown, dark brown and gray **SILT AND CLAY**, little fine to coarse sand, trace fine gravel, few stiff zones, occassional iron oxide staining, few shale and sandstone fragments, damp to moist. *(continued)*	691.0	31	7 9 13	31	100	SS-13	2.5-4.5	-	-	-	-	-	-	-	-	15	A-6a (V)	
	687.5	32																
Very-stiff to hard gray **SILT AND CLAY**, trace fine to coarse sand, trace fine gravel, few wood fragments, slightly organic, damp.		33																
@ 33.5' to 35.0' LOI = 3.0%.	685.5	34	5 7 9	23	100	SS-14	2.5-4.5	1	3	2	57	37	39	24	15	21	A-6a (10)	
Medium-stiff to stiff gray mottled with brown **SILT AND CLAY**, some fine to coarse sand, trace fine gravel, iron oxide staining, few sand seams, few very-stiff zones, damp to moist.		35																
		36																
		37	2 3 5	11	100	SS-15	0.5-1.5	-	-	-	-	-	-	-	-	26	A-6a (V)	
@ 38.0' to 39.0' Q_u = 2,241 psf, γ_{dry} = 106.9 pcf	682.0	38																
		39			92	ST-16A	1.0-2.2	5	7	17	43	28	31	19	12	21	A-6a (8)	
						ST-16B	-	-	-	-	-	-	-	-	-	-	A-3 (V)	
Medium-dense gray **FINE SAND**, trace to little coarse sand, trace silt, trace clay, trace fine gravel, moist.	679.5	40																
		41	3 7 9	23	89	SS-17A	-	-	-	-	-	-	-	-	-	17	A-3 (V)	
						SS-17B	-	-	-	-	-	-	-	-	-	13	A-1-b (V)	
Medium-dense gray **GRAVEL WITH SAND**, trace silt, trace clay, moist to wet.		42																
		43																
		44	10 12 17	41	33	SS-18	-	19	49	22	8	2	NP	NP	NP	22	A-1-b (0)	
	675.5	45																
SHALE, gray, severely weathered, very weak to weak, many clay pockets/seams.		46	31 50/2"	-	88	SS-19	-	-	-	-	-	-	-	-	-	15	Rock (V)	
		47																
		48																
	671.8	49	24 50/2"	-	88	SS-20	-	-	-	-	-	-	-	-	-	18	Rock (V)	
SHALE, gray, severely to highly weathered, very weak, laminated to thinly laminated, highly to moderately fractured, narrow to open, slightly rough, friable, fissile, laminated/sheared structure, poor to very poor surface, RQD = 28%, REC = 93%.		50																
		51																
		52	22		93	NQ-21											CORE	
		53																
		54																
@ 54.6' to 56.0' Q_u = 64 psi, γ_{dry} = 135.1 pcf	665.5	55																
SHALE, gray, slightly to moderately weathered, weak to slightly strong, laminated to thinly laminated, highly to moderately fractured, narrow, slightly rough, blocky/seamy/disturbed structure, fair surface, RQD = 51%, REC = 99%.		56																
		57	62		98	NQ-22											CORE	
		58																
		59																
		60																
		61	63		100	NQ-23											CORE	

W 683.6
W 682.0
W 678.0
TR

PLATE 26

S&ME JOB: 22170059B

PID: 112663	BR ID: N/A	PROJECT: LAK-90-2.93 SLIDE	STATION / OFFSET: 111+20, 223' LT	START: 5/16/24	END: 5/16/24	PG 3 OF 3	**B-007-4-23**

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	HOLE SEALED
SHALE, gray, slightly to moderately weathered, weak to slightly strong, laminated to thinly laminated, highly to moderately fractured, narrow, slightly rough, blocky/seamy/disturbed structure, fair surface, RQD = 51%, REC = 99%. *(continued)*	658.9	63																
@ 62.4' to 622.8' Q_u = 950 psi, γ_{dry} = 152.3 pcf		64																
@ 65.5', clay seam		65																
@ 65.6' - 67.3', highly weathered		66	28		97	NQ-24											CORE	
		67																
		68																
	651.8	69 EOB																

NOTES:
- Seepage observed at 37.4'.
- Groundwater encountered during drilling at 39.0'.
- Groundwater measured at 43.0' prior to rock coring.
- Groundwater measured in the augers at 6.0' after rock coring.
- Boring caved at 40.0', and water was measured at 6.0' after removing the augers.

NOTES: SEE ABOVE.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: BENTONITE AND CEMENT GROUT MIXTURE

S&ME JOB: 22170059B

PROJECT: LAK-90-2.93 SLIDE	DRILLING FIRM / OPERATOR: OTB / J. MINCHAK	DRILL RIG: OTB ATV D50	STATION / OFFSET: 112+57, 151' LT	EXPLORATION ID B-008-0-22
TYPE: LANDSLIDE	SAMPLING FIRM / LOGGER: S&ME / S. SMITH	HAMMER: CME AUTOMATIC	ALIGNMENT: IR-90	
PID: 112663 BR ID: N/A	DRILLING METHOD: 3-1/4" HSA	CALIBRATION DATE: 12/22/22	ELEVATION: 753.0 (MSL) EOB: 77.4 ft.	PAGE 1 OF 3
START: 12/1/22 END: 12/5/22	SAMPLING METHOD: SPT	ENERGY RATIO (%): 79.1	LAT / LONG: 41.600102 N, 81.442121 W	

MATERIAL DESCRIPTION AND NOTES	ELEV. 753.0	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	HOLE SEALED
ASPHALT - 13 INCHES	751.9																	
GRANULAR BASE - 8 INCHES	751.2																	
FILL: Very-stiff to hard brown and gray **SILT AND CLAY**, some fine to coarse sand, trace fine gravel, damp.			4 6 8	18	100	SS-1	3.5-4.5+	9	10	13	34	34	28	17	11	12	A-6a (7)	
			5 15 9	32	100	SS-2A	4.25	-	-	-	-	-	-	-	-	17	A-6a (V)	
						SS-2B	4.5+	-	-	-	-	-	-	-	-	10	A-6a (V)	
	747.8	W 748.0	5 4 2	8	100	SS-3A	-	-	-	-	-	-	-	-	-	6	A-6a (V)	
						SS-3B	2.0-4.5	-	-	-	-	-	-	-	-	17	A-6a (V)	
FILL: Stiff to very-stiff brown and dark brown with gray **SILT AND CLAY**, little to some fine to coarse sand, trace to little fine gravel, few hard zones, few shale fragments, damp to moist.			2 4 5	12	61	SS-4	1.0-2.5	-	-	-	-	-	-	-	-	18	A-6a (V)	
			2 3 4	9	67	SS-5A	1.75-2.75	-	-	-	-	-	-	-	-	17	A-6a (V)	
						SS-5B	1.0	-	-	-	-	-	-	-	-	17	A-6a (V)	
			3 6 6	16	89	SS-6A	1.5-2.0	-	-	-	-	-	-	-	-	16	A-6a (V)	
						SS-6B	2.5-4.0	-	-	-	-	-	-	-	-	13	A-6a (V)	
			4 6 7	17	89	SS-7	2.5	-	-	-	-	-	-	-	-	18	A-6a (V)	
			9 4 2	8	78	SS-8A	2.5-3	-	-	-	-	-	-	-	-	10	A-6a (V)	
@ 12.8' becoming light brown and gray						SS-8B	2.5	-	-	-	-	-	-	-	-	18	A-6a (V)	
			3 3 3	8	56	SS-9	2.5-3	-	-	-	-	-	-	-	-	11	A-6a (V)	
			3 3 6	12	67	SS-10	2.5-3.25	-	-	-	-	-	-	-	-	14	A-6a (V)	
			3 3 4	9	94	SS-11A	2.0-3.0	-	-	-	-	-	-	-	-	16	A-6a (V)	
						SS-11B	2.0-3.5	-	-	-	-	-	-	-	-	15	A-6a (V)	
@ 18.0' to 19.5' few red fine sand seams			3 4 6	13	100	SS-12	2.0-3.5	-	-	-	-	-	-	-	-	14	A-6a (V)	
	733.5																	
FILL: Very-stiff to hard brown and gray **SILT AND CLAY**, little to some fine gravel, little fine to coarse sand, few shale fragments, damp to moist.		W 732.0	4 7 9	21	100	SS-13	4.0-4.5	27	8	9	27	29	33	19	14	13	A-6a (6)	
@ 21.0' to 21.3' many shale fragments						SS-14A	-	-	-	-	-	-	-	-	-	10	A-6a (V)	
			4 4 9	17	78	SS-14B	4.5+	-	-	-	-	-	-	-	-	13	A-6a (V)	
			5 9 11	26	89	SS-15A	4.5+	-	-	-	-	-	-	-	-	13	A-6a (V)	
						SS-15B	4.5+	-	-	-	-	-	-	-	-	12	A-6a (V)	
			3 4 5	12	72	SS-16	3.0	-	-	-	-	-	-	-	-	21	A-6a (V)	
			4 7 10	22	100	SS-17A	3.0	-	-	-	-	-	-	-	-	17	A-6a (V)	
						SS-17B	4.5+	-	-	-	-	-	-	-	-	15	A-6a (V)	
			4 7 7	18	78	SS-18	3.0	-	-	-	-	-	-	-	-	16	A-6a (V)	
			4 7 8	20	100	SS-19	4.5+	18	9	10	33	30	35	21	14	10	A-6a (7)	

S&ME ODOT LOG (8.5X11) - SGE 01/2019 - OH DOT.GDT - 6/28/24 15:06 - R:\SERVICE LINES\CS-2557\CLEVELAND\01 - LABORATORY\02 - GINT\WPROJECTS\22170059B-NEW.GPJ

PLATE 28

PID: 112663	BR ID: N/A	PROJECT: LAK-90-2.93 SLIDE	STATION / OFFSET: 112+57, 151' LT	START: 12/1/22	END: 12/5/22	PG 2 OF 3	**B-008-0-22**

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	HOLE SEALED
FILL: Very-stiff to hard brown and gray **SILT AND CLAY**, little to some fine gravel, little fine to coarse sand, few shale fragments, damp to moist. *(continued)*	723.0	31	3 6 7	17	94	SS-20	3.0-4.5+	-	-	-	-	-	-	-	-	19	A-6a (V)	
		32	6 9 11	26	61	SS-21	4.5+	-	-	-	-	-	-	-	-	16	A-6a (V)	
		33	4 8 8	21	78	SS-22	2.5-4.5	-	-	-	-	-	-	-	-	23	A-6a (V)	
		34	3 8 10	24	78	SS-23	2.0-2.75	-	-	-	-	-	-	-	-	18	A-6a (V)	
	717.0	35																
FILL: Very-stiff to hard brown to dark gray **SILT AND CLAY**, trace fine to coarse sand, trace fine gravel, occasional varved zones, damp.		36	7 10 14	32	100	SS-24	4.5+	3	2	8	41	46	33	18	15	14	A-6a (10)	
		37	6 8 11	25	100	SS-25	4.5+	-	-	-	-	-	-	-	-	15	A-6a (V)	
		38	7 11 12	30	100	SS-26	4.5+	-	-	-	-	-	-	-	-	15	A-6a (V)	
		39	4 7 8	20	100	SS-27	3.5-4.0	-	-	-	-	-	-	-	-	16	A-6a (V)	
		40	6 10 13	30	100	SS-28	4.5	-	-	-	-	-	-	-	-	15	A-6a (V)	
@ 43.5' to 44.1' "and" fine gravel		41																
@ 44.1' becoming brown and gray		42																
		43																
		44	6 10 11	28	100	SS-29A	3.5-4.5	42	9	8	21	20	33	19	14	12	A-6a (2)	
						SS-29B	4.5+	-	-	-	-	-	-	-	-	15	A-6a (V)	
		45	5 8 13	28	100	SS-30	3.0-4.5	-	-	-	-	-	-	-	-	16	A-6a (V)	
		46	9 11 14	33	100	SS-31	4.5+	-	-	-	-	-	-	-	-	17	A-6a (V)	
		47	7 9 11	26	100	SS-32	4.5	2	4	9	41	44	33	18	15	16	A-6a (10)	
		48	4 7 11	24	78	SS-33A	3.5	-	-	-	-	-	-	-	-	11	A-6a (V)	
						SS-33B	4.5	-	-	-	-	-	-	-	-	10	A-6a (V)	
		49	7 10 12	29	100	SS-34	2.5-4.5	-	-	-	-	-	-	-	-	14	A-6a (V)	
	699.9	50																
Stiff gray to dark gray **SILT AND CLAY**, some fine to coarse sand, trace fine gravel, slightly organic, few roots, possible buried topsoil, damp.	699.0																	
@ 53.1' to 53.7' LOI = 2.3%		51	6 10 12	29	78	SS-35A	3.5-4.5	-	-	-	-	-	-	-	-	12	A-6a (V)	
						SS-35B	1.5	9	5	19	33	34	31	18	13	17	A-6a (8)	
		52	5 8 15	30	100	SS-36	3.5-4.5+	-	-	-	-	-	-	-	-	16	A-6a (V)	
		53																
Very-stiff to hard brown mottled gray **SILT AND CLAY**, little fine to coarse sand, trace fine gravel, damp.		54	6 10 15	33	89	SS-37	4.5+	-	-	-	-	-	-	-	-	15	A-6a (V)	
		55	8 9 12	28	100	SS-38A	4.5+	-	-	-	-	-	-	-	-	16	A-6a (V)	
						SS-38B	2.75	-	-	-	-	-	-	-	-	17	A-6a (V)	
		56	6 12 15	36	100	SS-39	3.5-4.5	3	6	11	40	40	33	19	14	16	A-6a (10)	
		57																
		58																
		59																
		60	7 10 11	28	89	SS-40	2.0-2.75	-	-	-	-	-	-	-	-	16	A-6a (V)	
		61																

S&ME JOB: 22170059B

PID: 112663	BR ID: N/A	PROJECT: LAK-90-2.93 SLIDE	STATION / OFFSET: 112+57, 151' LT	START: 12/1/22	END: 12/5/22	PG 3 OF 3	**B-008-0-22**

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	HOLE SEALED
Very-stiff to hard brown mottled gray **SILT AND CLAY**, little fine to coarse sand, trace fine gravel, damp. *(continued)*	690.8	63																
@ 64.2' few wood fragments		64	5 8 10	24	78	SS-41	2.0-3.0	-	-	-	-	-	-	-	-	18	A-6a (V)	
	686.0	65																
Stiff orange-brown mottled with gray **SILT AND CLAY**, little fine to coarse sand, trace fine gravel, moist.		66																
		67																
		68																
		69	4 4 7	15	100	SS-42	1.5-2.0	2	2	16	45	35	36	21	15	25	A-6a (10)	
	679.5	70																
		71																
		72																
		73																
Medium-dense gray **COARSE AND FINE SAND**, little silt, trace clay, trace fine gravel, wet.		74	8 8 9	22	67	SS-43	-	3	21	60	12	4	NP	NP	NP	20	A-3a (0)	
	676.0	75																
		76																
SHALE, gray, highly to severely weathered, very weak.	675.6	77 TR EOB	50/5"	-	100	SS-44	-	-	-	-	-	-	-	-	-	17	Rock (V)	

NOTES:
- Seepage encountered at 5.0' during drilling.
- Water encountered at 21' during drilling.
- Drilling was paused at a depth of 42' at the end of the day on 12/1/22. Before resuming drilling on 12/2/22, water was measured at a depth of 17'.
- Drilling was paused at a depth of 61.5' at the end of the day on 12/2/22. Before resuming drilling on 12/5/22, water was measured at a depth of 25'.
- Water measured at a depth of 44' prior to removing augers.

NOTES: SEE ABOVE.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: ASPHALT PATCH; BENTONITE AND CEMENT GROUT MIXTURE; PLASTIC HOLE PLUG DEVICE

PLATE 30

S&ME JOB: 22170059B

PROJECT: LAK-90-2.93 SLIDE	DRILLING FIRM / OPERATOR: OTB / D. HEPNER	DRILL RIG: OTB ATV D50	STATION / OFFSET: 112+45, 231' LT	EXPLORATION ID B-008-1-22
TYPE: LANDSLIDE	SAMPLING FIRM / LOGGER: S&ME / S. SMITH	HAMMER: CME AUTOMATIC	ALIGNMENT: IR-90	
PID: 112663 BR ID: N/A	DRILLING METHOD: 3-1/4" HSA	CALIBRATION DATE: 12/22/22	ELEVATION: 718.3 (MSL) EOB: 47.7 ft.	PAGE 1 OF 2
START: 7/17/23 END: 7/18/23	SAMPLING METHOD: SPT / ST	ENERGY RATIO (%): 79.1	LAT / LONG: 41.600120 N, 81.442784 W	

MATERIAL DESCRIPTION AND NOTES	ELEV. 718.3	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	MON. WELL
FILL: Stiff to very-stifff brown, dark brown and gray **SILT AND CLAY**, little fine to coarse sand, trace to little fine gravel, few hard zones, many shale fragments, few roots, damp.		1	1 2 3	7	56	SS-1	1.7-3.0	13	9	8	32	38	36	21	15	16	A-6a (9)	
		2	2 2 3	7	28	SS-2	1.5-3.0	-	-	-	-	-	-	-	-	18	A-6a (V)	
- ST-33 from offset boring from 3.0' to 5.0' with 63% recovery.		3				SS-3	1.5-2.0	-	-	-	-	-	-	-	-	15	A-6a (V)	
@ 3.0' to 5.0' Q_u = 2,470 psf, γ_{dry} = 115.7 pcf		4	2 2 2	5	22	ST-33	4.2	9	6	9	36	40	33	18	15	17	A-6a (10)	
		5	2 1 2	4	39	SS-4	1.5-3.0	-	-	-	-	-	-	-	-	14	A-6a (V)	
	712.3	6																
FILL: Very-stiff to hard brown to gray **SILTY CLAY**, trace to little fine to coarse sand, trace fine gravel, damp.		7	3 5 4	12	67	SS-5	2.5-4.5	1	2	6	44	47	35	18	17	17	A-6b (11)	
		8	3 3 5	11	39	SS-6	2.0-4.5+	-	-	-	-	-	-	-	-	17	A-6b (V)	
		9	3 5 5	13	67	SS-7	3.0-4.5	-	-	-	-	-	-	-	-	17	A-6b (V)	
@ 10.5' to 11.3' many shale fragments		10																
		11	5 5 6	15	78	SS-8A	4.5+	-	-	-	-	-	-	-	-	13	A-6b (V)	
		12				SS-8B	3.0-4.5	-	-	-	-	-	-	-	-	18	A-6b (V)	
@ 12.0' few brick fragments		13	4 6 9	20	61	SS-9	3.0-4.5	2	3	8	44	43	36	18	18	17	A-6b (11)	
		14	3 4 4	11	72	SS-10	3.0-4.0	-	-	-	-	-	-	-	-	19	A-6b (V)	
@ 15.0' stiff	702.8	15				SS-11A	1.5	-	-	-	-	-	-	-	-	18	A-6b (V)	
FILL: Very-stiff to hard brown to gray **SILT AND CLAY**, little fine to coarse sand, trace fine to coarse gravel, few stiff zones, damp to moist.		16	2 3 3	8	67	SS-11B	1.5	-	-	-	-	-	-	-	-	22	A-6a (V)	
		17			90	ST-12	2.8-4.5	10	7	9	37	37	33	19	14	16	A-6a (9)	
@ 16.5' to 18.5' Q_u = 3,800 psf, γ_{dry} = 116.2 pcf		18																
@ 19.0' few roots		19	5 6 9	20	67	SS-13	3.0-4.5	-	-	-	-	-	-	-	-	16	A-6a (V)	
		20																
		21	6 8 6	18	100	SS-14A	3.0-4.5	-	-	-	-	-	-	-	-	14	A-6a (V)	
		22				SS-14B	3.5-4.5	-	-	-	-	-	-	-	-	15	A-6a (V)	
		23	4 6 10	21	67	SS-15	3.0-4.5+	-	-	-	-	-	-	-	-	16	A-6a (V)	
		24	4 5 7	16	89	SS-16	1.7-2.0	4	4	9	40	43	33	18	15	18	A-6a (10)	
		25	4 7 10	22	78	SS-17	3.5-4.5+	-	-	-	-	-	-	-	-	15	A-6a (V)	
		26																
		27	7 9 13	29	78	SS-18	4.5+	-	-	-	-	-	-	-	-	15	A-6a (V)	
		28	6 7 9	21	67	SS-19	4.5+	-	-	-	-	-	-	-	-	17	A-6a (V)	
		29	5				2.7-											

S&ME JOB: 22170059B

PID: 112663	BR ID: N/A	PROJECT: LAK-90-2.93 SLIDE	STATION / OFFSET: 112+45, 231' LT	START: 7/17/23	END: 7/18/23	PG 2 OF 2	**B-008-1-22**

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	MON. WELL
FILL: Very-stiff to hard brown to gray **SILT AND CLAY**, little fine to coarse sand, trace fine to coarse gravel, few stiff zones, damp to moist. *(continued)*	688.3		7 9	21	89	SS-20	4.5+	4	5	9	39	43	31	18	13	16	A-6a (9)	
		31	4 7 9	21	67	SS-21	3.0-4.5+	-	-	-	-	-	-	-	-	15	A-6a (V)	
		32 33	5 9 13	29	72	SS-22	4.5+	-	-	-	-	-	-	-	-	17	A-6a (V)	
		34	5 6 9	20	72	SS-23	4.0-4.5+	-	-	-	-	-	-	-	-	15	A-6a (V)	
	683.1	35																
POSSIBLE FILL: Stiff to very-stiff gray mottled with brown **SILT AND CLAY**, little fine to coarse sand, trace fine gravel, damp to moist.	681.4	36	3 5 8	17	100	SS-24	1.7-3.0	4	5	10	40	41	33	19	14	18	A-6a (10)	
Stiff gray and dark gray **SILT AND CLAY**, trace fine to coarse and, slightly organic (LOI = 3.4%), moist.	680.8	37	3 6 8	18	78	SS-25A	1.2-1.8	-	-	-	-	-	-	-	-	29	A-6a (V)	
	W 680.7																	
	W 680.1	38				SS-25B	-	-	-	-	-	-	-	-	-	12	A-1-b (V)	
Medium-dense to dense brown and gray **GRAVEL WITH SAND**, trace silt, trace clay, many shale fragments, wet.		39	7 11 22	44	44	SS-26	-	-	-	-	-	-	-	-	-	17	A-1-b (V)	
		40	8 14 12	34	56	SS-27	-	-	-	-	-	-	-	-	-	12	A-1-b (V)	
@ 41.2' becoming gray to dark gray		41	5 8 7	20	72	SS-28	-	40	32	14	10	4	17	16	1	13	A-1-b (0)	
		42	4 6 8	18	78	SS-29	-	-	-	-	-	-	-	-	-	14	A-1-b (V)	
		43 44	5 8 12	26	100	SS-30	-	-	-	-	-	-	-	-	-	16	A-1-b (V)	
	671.7	45	8 12 50	82	100	SS-31A	-	-	-	-	-	-	-	-	-	16	A-1-b (V)	
	TR					SS-31B	-	-	-	-	-	-	-	-	-	8	Rock (V)	
SHALE, gray, highly to severely weathered, very weak to weak.	670.6	46 47	50	-	83	SS-32	-	-	-	-	-	-	-	-	-	11	Rock (V)	
	EOB																	

NOTES:
- Slope benching removed approximately 5' at cut edge. Elevation on log is at original ground surface.
- Seepage was encountered at 37.6' during drilling.
- Groundwater encountered at 38.2' during drilling.
- Water measured inside hollow-stem augers at 41' prior to removing augers.
- Installed groundwater monitoring well to 46' with the screened interval from 36' to 46'.

NOTES: SEE ABOVE.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: BENTONITE CHIPS; MONITORING WELL; SAND; SOIL CUTTINGS

S&ME ODOT LOG (8.5X11) - SGE 01/2019 - OH DOT.GDT - 6/28/24 15:06 - R:\SERVICE LINES\CS-2557\CLEVELAND\01 - LABORATORY\02 - GINT\WPROJECTS\22170059B-NEW.GPJ

PLATE 32

S&ME JOB: 22170059B

PROJECT: LAK-90-2.93 SLIDE	DRILLING FIRM / OPERATOR: OTB / J. MINCHAK	DRILL RIG: OTB ATV D50	STATION / OFFSET: 112+24, 216' LT
TYPE: LANDSLIDE	SAMPLING FIRM / LOGGER: S&ME / S. SMITH	HAMMER: CME AUTOMATIC	ALIGNMENT: IR-90
PID: 112663 BR ID: N/A	DRILLING METHOD: 3-1/4" HSA	CALIBRATION DATE: 12/22/22	ELEVATION: 724.4 (MSL) EOB: 72.0 ft.
START: 5/23/24 END: 5/24/24	SAMPLING METHOD: SPT / ST	ENERGY RATIO (%): 79.1	LAT / LONG: 41.600048 N, 81.442792 W

EXPLORATION ID **B-008-4-23**

MATERIAL DESCRIPTION AND NOTES	ELEV. 724.4	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	HOLE SEALED
Augered to 49.0' without split spoon sampling. See B-008-1-22 for stratigraphy.		1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29																

S&ME JOB: 22170059B

PID: 112663	BR ID: N/A	PROJECT: LAK-90-2.93 SLIDE	STATION / OFFSET: 112+24, 216' LT	START: 5/23/24	END: 5/24/24	PG 2 OF 3	**B-008-4-23**

MATERIAL DESCRIPTION AND NOTES	ELEV. 694.4	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	HOLE SEALED
Augered to 49.0' without split spoon sampling. See B-008-1-22 for stratigraphy. *(continued)*		31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48																
	675.4	49																
Medium-dense gray **COARSE AND FINE SAND**, little fine gravel, little silt, trace clay, wet.	675.1		9			SS-1A	-	-	-	-	-	-	-	-	-	-	A-3a (V)	
	674.5	TR 50	14 50/4"	-	94	SS-1B	-	-	-	-	-	-	-	-	-	-	A-2-6 (V)	
Medium-dense gray **GRAVEL WITH SAND, SILT AND CLAY**, moist.						SS-1C	-	-	-	-	-	-	-	-	-	-	Rock (V)	
	672.4	51 52																
SHALE, gray, severely to highly weathered, very weak to weak.																		
SHALE, gray, highly to moderately weathered, weak to slightly strong, laminated to thinly laminated, highly fractured to fractured, narrow to open, slightly rough, disintegrated to blocky/seamy/disturbed structure, poor to fair surface, RQD = 9%, REC = 90%. @ 52.0' to 56.3' SDI = 50.6%		53 54 55 56 57	0		80	NQ-2											CORE	
@ 60.5' to 60.9' Q_u = 1,763 psi, γ_{dry} = 154.6 pcf		58 59 60 61	13		97	NQ-3											CORE	

S&ME ODOT LOG (8.5X11) - SGE 01/2019 - OH DOT.GDT - 6/28/24 15:06 - R:\SERVICE LINES\CS-2557\CLEVELAND\01 - LABORATORY\02 - GINTW\PROJECTS\22170059B-NEW.GPJ

PLATE 34

S&ME JOB: 22170059B

PID: 112663	BR ID: N/A	PROJECT: LAK-90-2.93 SLIDE	STATION / OFFSET: 112+24, 216' LT	START: 5/23/24	END: 5/24/24	PG 3 OF 3	**B-008-4-23**

MATERIAL DESCRIPTION AND NOTES	ELEV. 662.2	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	HOLE SEALED
SHALE, gray, highly to moderately weathered, weak to slightly strong, laminated to thinly laminated, highly fractured to fractured, narrow to open, slightly rough, disintegrated to blocky/seamy/disturbed structure, poor to fair surface, RQD = 9%, REC = 90%. *(continued)*	657.4	63 64 65 66 67	15		95	NQ-4											CORE	
SHALE, gray, slightly weathered, weak to slightly strong, laminated to thinly laminated, fractured to moderately fractured, narrow, slightly rough, blocky/seamy/disturbed structure, fair to good surface, RQD = 63%, REC = 97%. @ 69.0' to 69.4' Q_u = 1,133 psi, γ_{dry} = 154.8 pcf	652.4	67 68 69 70 71 72 EOB	63		97	NQ-5											CORE	

NOTES:
- Water added inside augers at 49.0' due to heaving sand.
- Water observed at ground surface at the end of the day on 5/23/24.
- Water was measured at 22.5' in the augers when drilling resumed, prior to rock coring, on 5/24/24.
- Boring caved at 26' and water was measured at 25.0' after removing the augers.
- No core recovery from 52.0' to 53.0'.
- Driller reported zero water return while coring from 67.0' to 70.0'.

NOTES: SEE ABOVE.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: BENTONITE AND CEMENT GROUT MIXTURE

PLATE 35

S&ME JOB: 22170059B

PROJECT: LAK-90-2.93 SLIDE	DRILLING FIRM / OPERATOR: OTB / J. MINCHAK	DRILL RIG: OTB ATV D50	STATION / OFFSET: 113+35, 207' LT
TYPE: LANDSLIDE	SAMPLING FIRM / LOGGER: S&ME / S. SMITH	HAMMER: CME AUTOMATIC	ALIGNMENT: IR-90
PID: 112663 BR ID: N/A	DRILLING METHOD: 3-1/4" HSA	CALIBRATION DATE: 12/22/22	ELEVATION: 728.5 (MSL) EOB: 80.0 ft.
START: 5/22/24 END: 5/23/24	SAMPLING METHOD: SPT / ST	ENERGY RATIO (%): 79.1	LAT / LONG: 41.600276 N, 81.442505 W

EXPLORATION ID **B-009-1-23**

PAGE 1 OF 3

MATERIAL DESCRIPTION AND NOTES	ELEV. 728.5	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	MON. WELL
FILL: Very-stiff to hard brown **SILT AND CLAY**, little fine gravel, little fine to coarse sand, few shale fragments, damp.		1–4	2 3 4	9	56	SS-1	2.0-3.0	-	-	-	-	-	-	-	-	16	A-6a (V)	
		4–5	4 5 4	12	100	SS-2A	-	-	-	-	-	-	-	-	-	10	A-6a (V)	
						SS-2B	3.5-4.5	-	-	-	-	-	-	-	-	18	A-6a (V)	
		6–7	2 3 2	7	72	SS-3	3.5-4.5	18	9	8	37	28	30	18	12	14	A-6a (7)	
		9–10	4 3 5	11	67	SS-4A	4.5+	-	-	-	-	-	-	-	-	18	A-6a (V)	
						SS-4B	2.5-3.5	-	-	-	-	-	-	-	-	11	A-6a (V)	
	718.0																	
FILL: Stiff to very-stiff brown **SANDY SILT**, some to "and" fine to coarse gravel, little clay, damp.		11–12	2 3 3	8	56	SS-5	2.0-2.5	-	-	-	-	-	-	-	-	15	A-4a (V)	
@ 13.5' to 15.2' Q_u = 1,662 psf, γ_{dry} = 119.3 pcf		14–15			83	ST-6	-	36	10	9	32	13	24	14	10	11	A-4a (2)	
	711.8																	
FILL: Very-stiff to hard brown and gray **SILT AND CLAY**, little fine gravel, little fine to coarse sand, damp.		16–17	5 4 8	16	89	SS-7A	-	-	-	-	-	-	-	-	-	10	A-4a (V)	
						SS-7B	2.0-2.5	-	-	-	-	-	-	-	-	13	A-6a (V)	
	709.7																	
FILL: Loose gray **COARSE AND FINE SAND**, some clay, little silt, organic staining, slight organic odor, moist. @ 18.8' to 19.7' LOI = 0.6%.	708.8	19–20	2 3 4	9	78	SS-8A	2.0-4.5	-	-	-	-	-	-	-	-	15	A-6a (V)	
						SS-8B	-	-	-	-	-	-	-	-	-	16	A-3a (V)	
FILL: Stiff to hard gray **SILT AND CLAY**, little fine to coarse gravel, little fine to coarse sand, iron oxide staining, few roots, damp to moist.		21–22	3 3 5	11	56	SS-9	1.5-2.5	-	-	-	-	-	-	-	-	14	A-6a (V)	
	704.4																	
FILL: Very-stiff to hard gray and brown **SILT AND CLAY**, some fine gravel, some fine to coarse sand, few stiff zones, few shale fragments, damp.		24–25	5 7 11	24	72	SS-10A	4.5+	-	-	-	-	-	-	-	-	12	A-6a (V)	
						SS-10B	4.5+	-	-	-	-	-	-	-	-	10	A-6a (V)	
		26–27	4 5 4	12	89	SS-11	1.8-2.5	22	14	5	45	14	29	16	13	12	A-6a (6)	
		29	4 7 7	18	94	SS-12	2.5-4.5	-	-	-	-	-	-	-	-	19	A-6a (V)	

PLATE 36

S&ME JOB: 22170059B

PID: 112663	BR ID: N/A	PROJECT: LAK-90-2.93 SLIDE	STATION / OFFSET: 113+35, 207' LT	START: 5/22/24	END: 5/23/24	PG 2 OF 3	**B-009-1-23**

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	MON. WELL
FILL: Very-stiff to hard gray and brown **SILT AND CLAY**, some fine gravel, some fine to coarse sand, few stiff zones, few shale fragments, damp. *(continued)*	698.5	31	7 11 13	32	78	SS-13	3.0-4.5	-	-	-	-	-	-	-	-	14	A-6a (V)	
		32																
		33																
		34	4 6 10	21	72	SS-14	2.5-4.5	-	-	-	-	-	-	-	-	13	A-6a (V)	
		35																
		36																
		37	6 12 16	37	0	SS-15	-	-	-	-	-	-	-	-	-	-		
	690.5	38																
Medium-stiff to very-stiff brown mottled with gray **SILTY CLAY**, little fine to coarse gravel, little fine to coarse sand, damp to moist.		39	2 2 3	7	94	SS-16	0.5-1.2	-	-	-	-	-	-	-	-	22	A-6b (V)	
@ 39.6', sand seam		40																
		41																
@ 41.0' to 42.9' Q_u = 712 psf, γ_{dry} = 102.4 pcf		42			96	ST-17	-	20	9	8	37	26	35	19	16	21	A-6b (8)	
		43																
@ 43.6' - 43.7', few wood fragments		44	5 4 4	11	100	SS-18	1.2-1.5	-	-	-	-	-	-	-	-	27	A-6b (V)	
@ 44.4', sand seam		45																
		46																
	681.7	47	3 5 9	18	100	SS-19A	2.0-2.5	-	-	-	-	-	-	-	-	20	A-6b (V)	
Medium-dense gray **GRAVEL WITH SAND, SILT AND CLAY**, moist to wet.		W 680.5				SS-19B	-	-	-	-	-	-	-	-	-	20	A-2-6 (V)	
	679.8	48																
Medium-dense gray **GRAVEL WITH SAND**, little silt, wet.		49	6 9 10	25	67	SS-20A	-	-	-	-	-	-	-	-	-	30	A-2-6 (V)	
		50				SS-20B	-	-	-	-	-	-	-	-	-	10	A-1-b (V)	
		51	5 5 8	17	56	SS-21	-	32	39	16	13	0	NP	NP	NP	15	A-1-b (0)	
		52																
		53																
	674.4	54	8 9 10	25	67	SS-22A	-	-	-	-	-	-	-	-	-	12	A-1-b (V)	
Medium-dense gray **FINE SAND**, trace silt, trace clay, wet						SS-22B	-	-	-	-	-	-	-	-	-	27	A-3 (V)	
	673.0	TR 55																
SHALE, gray, severely weathered, very weak to weak, few clay seams.		56	50	-	100	SS-23A	-	-	-	-	-	-	-	-	-	13	Rock (V)	
						SS-23B	-	-	-	-	-	-	-	-	-	6	Rock (V)	
		57																
		58																
		59																
	668.5	60																
- SEE DESCRIPTION ON NEXT PAGE -		61																

S&ME JOB: 22170059B

PID: 112663	BR ID: N/A	PROJECT: LAK-90-2.93 SLIDE	STATION / OFFSET: 113+35, 207' LT	START: 5/22/24	END: 5/23/24	PG 3 OF 3	**B-009-1-23**

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	MON. WELL
SHALE, gray, slightly to moderately weathered, weak to slightly strong, laminated to thinly laminated, highly to moderately fractured, narrow, slightly rough, blocky/seamy/disturbed structure, fair to good surface, RQD = 45%, REC = 96%. *(continued)*	666.4	63																
@ 64.3' to 64.7' Q_u = 924 psi, γ_{dry} = 154.2 pcf		64																
		65	35		93	NQ-24											CORE	
		66																
		67																
		68																
		69																
		70																
@ 70.1' to 70.5' Q_u = 1,448 psi, γ_{dry} = 156.8 pcf		71																
		72																
		73																
		74																
		75	56		99	NQ-24											CORE	
		76																
		77																
		78																
		79																
	648.5	EOB 80																

NOTES:
- Seepage observed at 3.6', 4.0', 7.0', 11.6', 18.8', 39.6', and 46.0'.
- Groundwater encountered during drilling at 48.0'.
- Water added inside augers at 50.0' due to heaving sand.
- Boring advanced to 55.0' at end of day 5/21/24.
- Water measured at 15.0' in augers before resuming drilling on 5/22/24.

NOTES: SEE ABOVE.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: MONITORING WELL

S&ME JOB: 22170059B

PROJECT: LAK-90-2.93 SLIDE	DRILLING FIRM / OPERATOR: S&ME / K. HARPER	DRILL RIG: HAND AUGER	STATION / OFFSET: 107+42, 374' LT
TYPE: LANDSLIDE	SAMPLING FIRM / LOGGER: S&ME / M. KHAN	HAMMER: HAND SAMPLING	ALIGNMENT: IR-90
PID: 112663 BR ID: N/A	DRILLING METHOD: HAND AUGER	CALIBRATION DATE: N/A	ELEVATION: 687.4 (MSL) EOB: 6.0 ft.
START: 2/1/23 END: 2/1/23	SAMPLING METHOD: SPT	ENERGY RATIO (%): 0	LAT / LONG: 41.599294 N, 81.443934 W

EXPLORATION ID **H-004-1-22**

PAGE 1 OF 1

MATERIAL DESCRIPTION AND NOTES	ELEV. 687.4	DEPTHS (W)	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	BACK FILL
Very-loose brown and gray **GRAVEL WITH SAND, SILT AND CLAY**, wet.	685.9	687.4 – 1	4 3 2		44	SS-1	-	30	21	16	19	14	28	17	11	21	A-2-6 (0)	
Very-loose brown and gray **GRAVEL WITH SAND AND SILT**, trace clay, wet.	684.4	1 – 2	10 8 5		33	SS-2	-	27	26	20	17	10	26	17	9	23	A-2-4 (0)	
Stiff (est.) gray **SILT AND CLAY**, some fine to coarse gravel, little fine to coarse sand, moist.	682.9	2 – 3	5 6 29		22	SS-3	-	34	16	7	27	16	35	20	15	21	A-6a (3)	
Medium-dense gray **GRAVEL WITH SAND**, trace silt, trace clay, damp to moist.	681.4	3 – 4 – 5	50 42 40		56	SS-4	-	48	26	11	10	5	23	17	6	11	A-1-b (0)	
		EOB 6																

NOTES:
- Boring performed in creek channel with water in the creek at/near the top of the boring.

NOTES: SEE ABOVE.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: NATURAL HOLE COLLAPSE

PLATE 39

S&ME JOB: 22170059B

PROJECT: LAK-90-2.93 SLIDE	DRILLING FIRM / OPERATOR: S&ME / K. HARPER	DRILL RIG: HAND AUGER	STATION / OFFSET: 108+89, 336' LT
TYPE: LANDSLIDE	SAMPLING FIRM / LOGGER: S&ME / M. KHAN	HAMMER: HAND SAMPLING	ALIGNMENT: IR-90
PID: 112663 BR ID: N/A	DRILLING METHOD: HAND AUGER	CALIBRATION DATE: N/A	ELEVATION: 686.0 (MSL) EOB: 6.0 ft.
START: 2/1/23 END: 2/1/23	SAMPLING METHOD: SPT	ENERGY RATIO (%): 0	LAT / LONG: 41.599578 N, 81.443495 W

EXPLORATION ID **H-006-0-22**

PAGE 1 OF 1

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	BACK FILL
Very-loose gray **GRAVEL**, some fine to coarse sand, trace silt, trace clay, moist to wet.	686.0	W 686.0	10 6 7		22	SS-1	-	65	15	9	11	-	-	-	-	13	A-1-a (V)	
	684.5	1																
Soft to medium-stiff gray **CLAY**, "and" silt, little fine to coarse sand, trace fine gravel, slightly to moderately organic, wet.	683.0	2	11 13 14		100	SS-2	0.5	3	4	9	50	34	43	28	15	50	A-7-6 (11)	
Soft to medium-stiff gray **SILT AND CLAY**, some fine to coarse sand, trace to little fine gravel, slightly to moderately organic, wet.		3	7 8 9		100	SS-3	0.5	2	11	23	39	25	38	27	11	46	A-6a (6)	
	680.0	4																
		5	15 30 30		100	SS-4	0.5	14	15	18	36	17	35	24	11	34	A-6a (4)	
		EOB 6																

NOTES:
- Boring performed in creek channel with water in the creek at/near the top of the boring.

NOTES: SEE ABOVE.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: NATURAL HOLE COLLAPSE

S&ME ODOT LOG (8.5X11) - SGE 01/2019 - OH DOT.GDT - 6/28/24 15:06 - R:\SERVICE LINES\CS-2557\CLEVELAND\01 - LABORATORY\02 - GINT\WPROJECTS\22170059B-NEW.GPJ

PLATE 40

S&ME JOB: 22170059B

PROJECT: LAK-90-2.93 SLIDE	DRILLING FIRM / OPERATOR: S&ME / K. HARPER	DRILL RIG: HAND AUGER	STATION / OFFSET: 110+24, 323' LT
TYPE: LANDSLIDE	SAMPLING FIRM / LOGGER: S&ME / M. KHAN	HAMMER: HAND SAMPLING	ALIGNMENT: IR-90
PID: 112663 BR ID: N/A	DRILLING METHOD: HAND AUGER	CALIBRATION DATE: N/A	ELEVATION: 685.3 (MSL) EOB: 6.0 ft.
START: 2/1/23 END: 2/1/23	SAMPLING METHOD: SPT	ENERGY RATIO (%): 0	LAT / LONG: 41.599868 N, 81.443152 W

EXPLORATION ID **H-007-2-22**

PAGE 1 OF 1

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	BACK FILL
Very-loose brown **GRAVEL WITH SAND**, trace to little silt, trace clay, wet.	685.3	W 685.3	10 14 12		33	SS-1	-	60	16	7	13	4	-	-	-	18	A-1-b (V)	
	682.3	1 2 3	10 13 16		11	SS-2	-	48	26	16	- 10 -		-	-	-	22	A-1-b (V)	
Loose gray **GRAVEL WITH SAND AND SILT**, trace clay, moist.	680.8	4	27 30 33		100	SS-3	-	57	22	6	11	4	25	18	7	14	A-2-4 (0)	
Medium-dense gray **COARSE AND FINE SAND**, some fine gravel, little silt, trace clay, moist to wet.	679.3	5 EOB 6	24 35 39		100	SS-4	-	29	17	36	14	4	NP	NP	NP	17	A-3a (0)	

NOTES:
- Boring performed in creek channel with water in the creek at/near the top of the boring.

NOTES: SEE ABOVE.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: NATURAL HOLE COLLAPSE

S&ME ODOT LOG (8.5X11) - SGE 01/2019 - OH DOT.GDT - 6/28/24 15:06 - R:\SERVICE LINES\CS-2557\CLEVELAND\01 - LABORATORY\02 - GINT\WPROJECTS\22170059B-NEW.GPJ

PLATE 41

S&ME JOB: 22170059B

PROJECT: LAK-90-2.93 SLIDE	DRILLING FIRM / OPERATOR: S&ME / K. HARPER	DRILL RIG: HAND AUGER	STATION / OFFSET: 112+01, 294' LT
TYPE: LANDSLIDE	SAMPLING FIRM / LOGGER: S&ME / M. KHAN	HAMMER: HAND SAMPLING	ALIGNMENT: IR-90
PID: 112663 BR ID: N/A	DRILLING METHOD: HAND AUGER	CALIBRATION DATE: N/A	ELEVATION: 683.3 (MSL) EOB: 4.5 ft.
START: 2/1/23 END: 2/1/23	SAMPLING METHOD: SPT	ENERGY RATIO (%): 0	LAT / LONG: 41.600221 N, 81.442660 W

EXPLORATION ID **H-008-3-22**

PAGE 1 OF 1

MATERIAL DESCRIPTION AND NOTES	ELEV. 683.3	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	BACK FILL
Very-loose gray and brown **GRAVEL WITH SAND**, little silt, trace clay, wet.	681.8	W 683.3 – 1	10 6 3		11	SS-1	-	26	44	10	- 20 -		-	-	-	20	A-1-b (V)	
Loose gray **GRAVEL WITH SAND AND SILT**, trace clay, moist.	680.3	– 2	17 26 34		28	SS-2	-	50	26	11	9	4	22	15	7	14	A-2-4 (0)	
Medium-dense gray **GRAVEL**, some fine to coarse sand, trace silt, trace clay, damp to moist.	678.8	– 3	53 41 41		72	SS-3	-	66	18	9	5	2	NP	NP	NP	8	A-1-a (0)	
		EOB – 4																

NOTES:
- Boring performed in creek channel with water in the creek at/near the top of the boring.
- Boring caved below a depth of 3 feet during sampling. Made multiple attempts to clear hole and continue sampling with no success.

NOTES: SEE ABOVE.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: NATURAL HOLE COLLAPSE

PLATE 42

S&ME JOB: 22170059B

PROJECT: LAK-90-2.93 SLIDE	DRILLING FIRM / OPERATOR: S&ME / K. HARPER	DRILL RIG: HAND AUGER	STATION / OFFSET: 113+23, 304' LT	EXPLORATION ID H-010-0-22
TYPE: LANDSLIDE	SAMPLING FIRM / LOGGER: S&ME / M. KHAN	HAMMER: HAND SAMPLING	ALIGNMENT: IR-90	
PID: 112663 BR ID: N/A	DRILLING METHOD: HAND AUGER	CALIBRATION DATE: N/A	ELEVATION: 682.6 (MSL) EOB: 3.8 ft.	PAGE 1 OF 1
START: 2/1/23 END: 2/1/23	SAMPLING METHOD: SPT	ENERGY RATIO (%): 0	LAT / LONG: 41.600510 N, 81.442398 W	

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	BACK FILL
Soft to medium-stiff brown mottled with gray **SILTY CLAY**, little fine to coarse sand, little fine gravel, moist.	682.6	682.6 W	3 3 4		33	SS-1	0.5	14	8	10	34	34	35	19	16	27	A-6b (9)	
	681.1	1																
Medium-stiff brown mottled with gray **SILT AND CLAY**, some fine to coarse gravel, little to some fine to coarse sand, moist.		2	9 13 25		61	SS-2	0.5-1.0	23	8	8	31	30	35	20	15	20	A-6a (7)	
	679.1	3																
SHALE, gray, severely weathered, very weak.	678.8	TR. EOB	34 70/3"	-	100	SS-3A	-	29	13	14	27	17	28	17	11	13	A-6a (2)	
						SS-3B	-	-	-	-	-	-	-	-	-	-	Rock (V)	

NOTES:
- Boring performed in creek channel with water in the creek at/near the top of the boring.

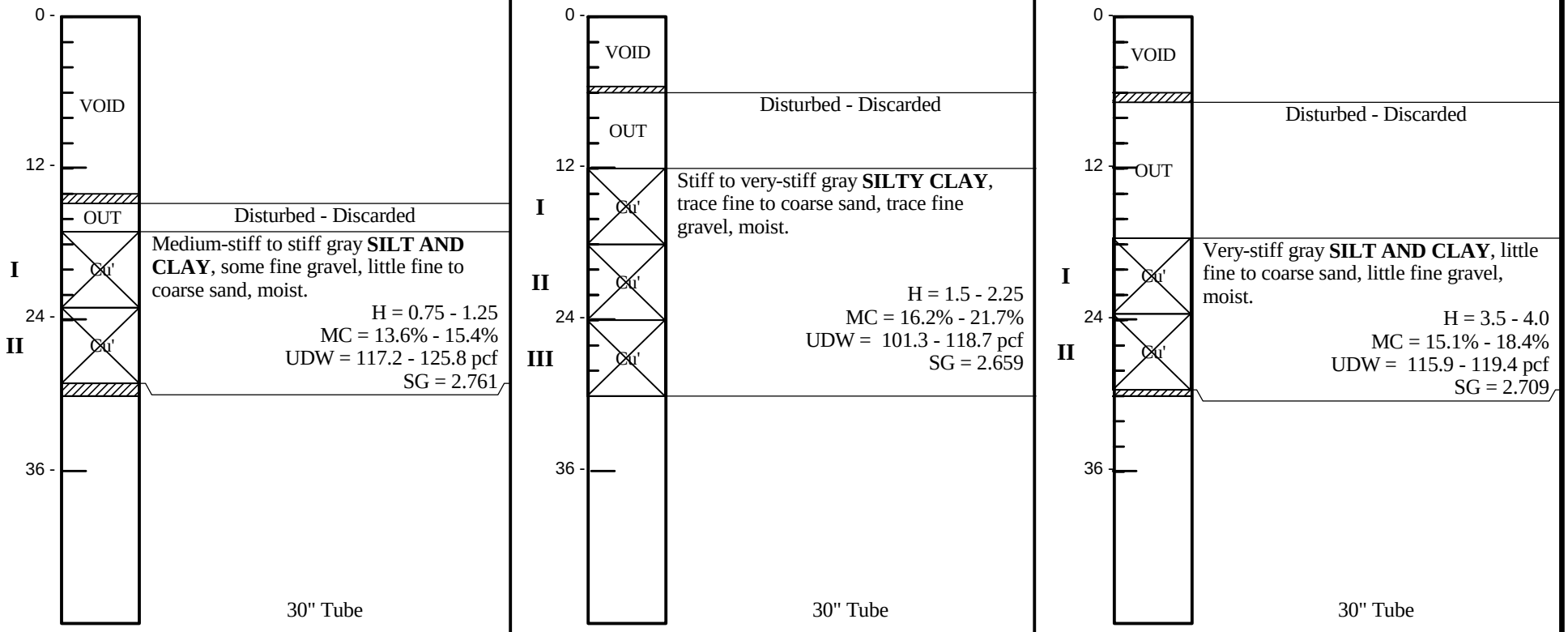
NOTES: SEE ABOVE.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: NATURAL HOLE COLLAPSE

JOB NUMBER : **22170059B**
PROJECT : **LAK-90-2.93 SLIDE**
PID : **112663**

LABORATORY LOG OF SHELBY TUBES

Boring : **B-001-1-22**	Sample : **ST-5**	Boring : **B-001-2-22**	Sample : **ST-15**	Boring : **B-004-0-22**	Sample : **ST-20**
Depth : **6.5' - 8.5'**	Recovery : **12.0"**	Depth : **21.0' - 23.0'**	Recovery : **18.0"**	Depth : **7.5' - 9.5'**	Recovery : **12.0"**



LEGEND

- Consolidation, Incremental
- Consolidation, C R S
- Permeability, Vertical / Horizontal
- Swelling, Test
- Wax
- Unconfined Compression Test
- Triaxial Compression Test

H - Hand Penetrometer (tsf)
Ds - Direct Shear
LOI - Loss on Ignition
AL - Atterberg Limits
MA - Sieve/Hydrometer
SG - Specific Gravity
TV - Torvane (tsf)
POR - Porosity
UDW - Unit Dry Weight
MC - Moisture Content
D_R - Relative Density
S - Sieve

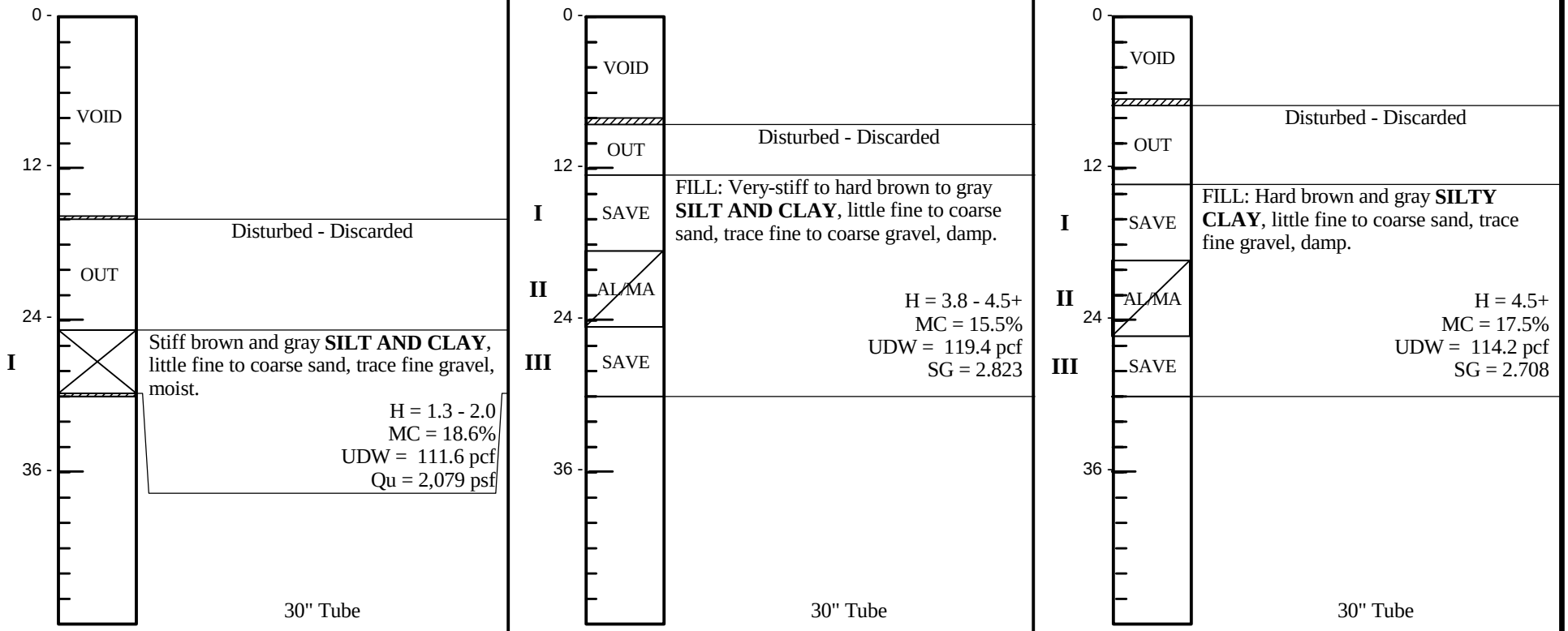
S&ME SHELBY TUBE LOG - OH_DOT.GDT - 6/24/24 15:55 - R:\SERVICE LINES\CS-2557\CLEVELAND\01 - LABORATORY\02 - GINT\WPROJECTS\22170059B-NEW.GPJ

PLATE 44

JOB NUMBER : **22170059B**
PROJECT : **LAK-90-2.93 SLIDE**
PID : **112663**

LABORATORY LOG OF SHELBY TUBES

Boring : **B-005-1-23**	Sample : **ST-1**	Boring : **B-007-0-22**	Sample : **ST-7**	Boring : **B-007-0-22**	Sample : **ST-13**
Depth : **4.0' - 6.0'**	Recovery : **5.0"**	Depth : **9.0' - 11.0'**	Recovery : **17.5"**	Depth : **18.5' - 20.5'**	Recovery : **16.75"**



LEGEND

- Consolidation, Incremental
- Consolidation, C R S
- Permeability, Vertical / Horizontal
- Swelling, Test
- Wax
- Unconfined Compression Test
- Triaxial Compression Test

H - Hand Penetrometer (tsf)
Ds - Direct Shear
LOI - Loss on Ignition
AL - Atterberg Limits
MA - Sieve/Hydrometer
SG - Specific Gravity
TV - Torvane (tsf)
POR - Porosity
UDW - Unit Dry Weight
MC - Moisture Content
D_R - Relative Density
S - Sieve

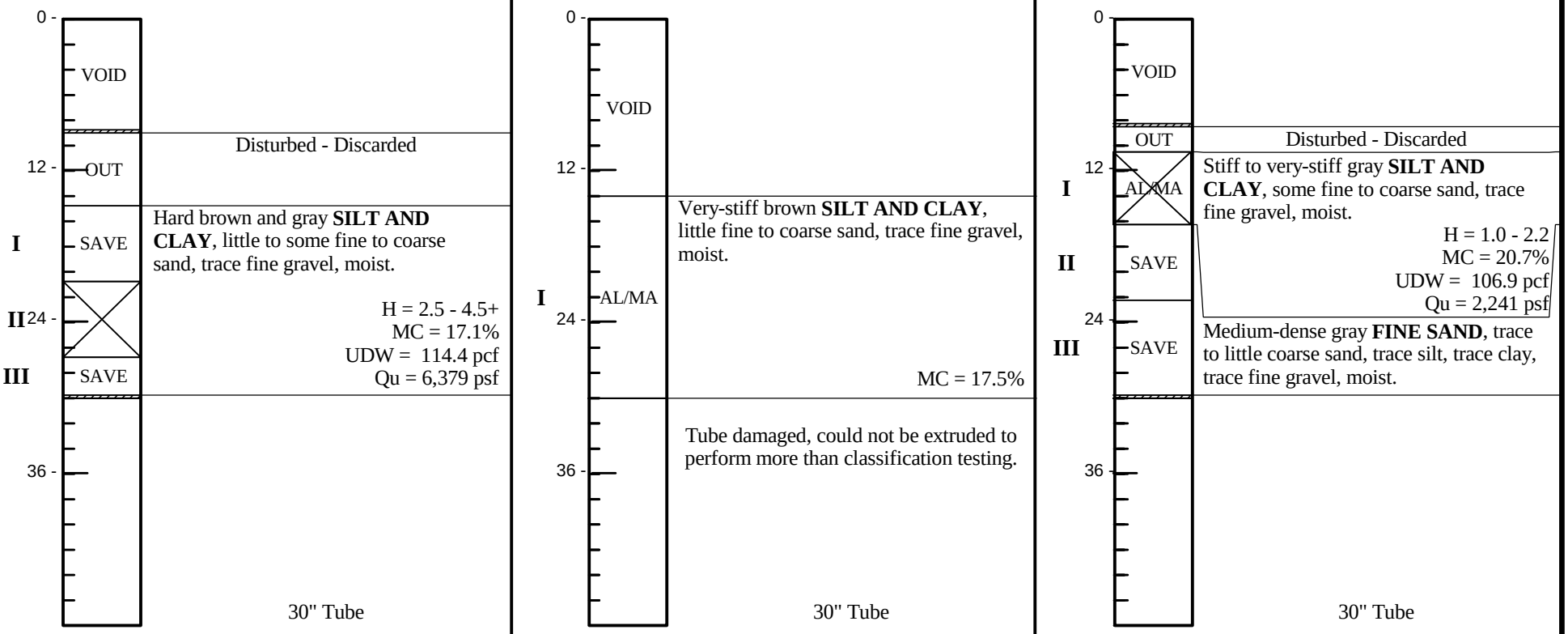
S&ME SHELBY TUBE LOG - OH_DOT.GDT - 6/24/24 15:55 - R:\SERVICE LINES\CS-2557\CLEVELAND\01 - LABORATORY\02 - GINT\WPROJECTS\22170059B-NEW.GPJ

PLATE 45

JOB NUMBER : **22170059B**
PROJECT : **LAK-90-2.93 SLIDE**
PID : **112663**

LABORATORY LOG OF SHELBY TUBES

Boring : **B-007-3-23**	Sample : **ST-1**	Boring : **B-007-4-23**	Sample : **ST-5**	Boring : **B-007-4-23**	Sample : **ST-16**
Depth : **8.0' - 10.0'**	Recovery : **15.0"**	Depth : **10.5' - 11.9'**	Recovery : **16.0"**	Depth : **38.0' - 40.0'**	Recovery : **19.5"**



LEGEND

- Consolidation, Incremental
- Consolidation, C R S
- Permeability, Vertical / Horizontal
- Swelling, Test
- Wax
- Unconfined Compression Test
- Triaxial Compression Test

H - Hand Penetrometer (tsf)	TV - Torvane (tsf)
Ds - Direct Shear	POR - Porosity
LOI - Loss on Ignition	UDW - Unit Dry Weight
AL - Atterberg Limits	MC - Moisture Content
MA - Sieve/Hydrometer	D_R - Relative Density
SG - Specific Gravity	S - Sieve

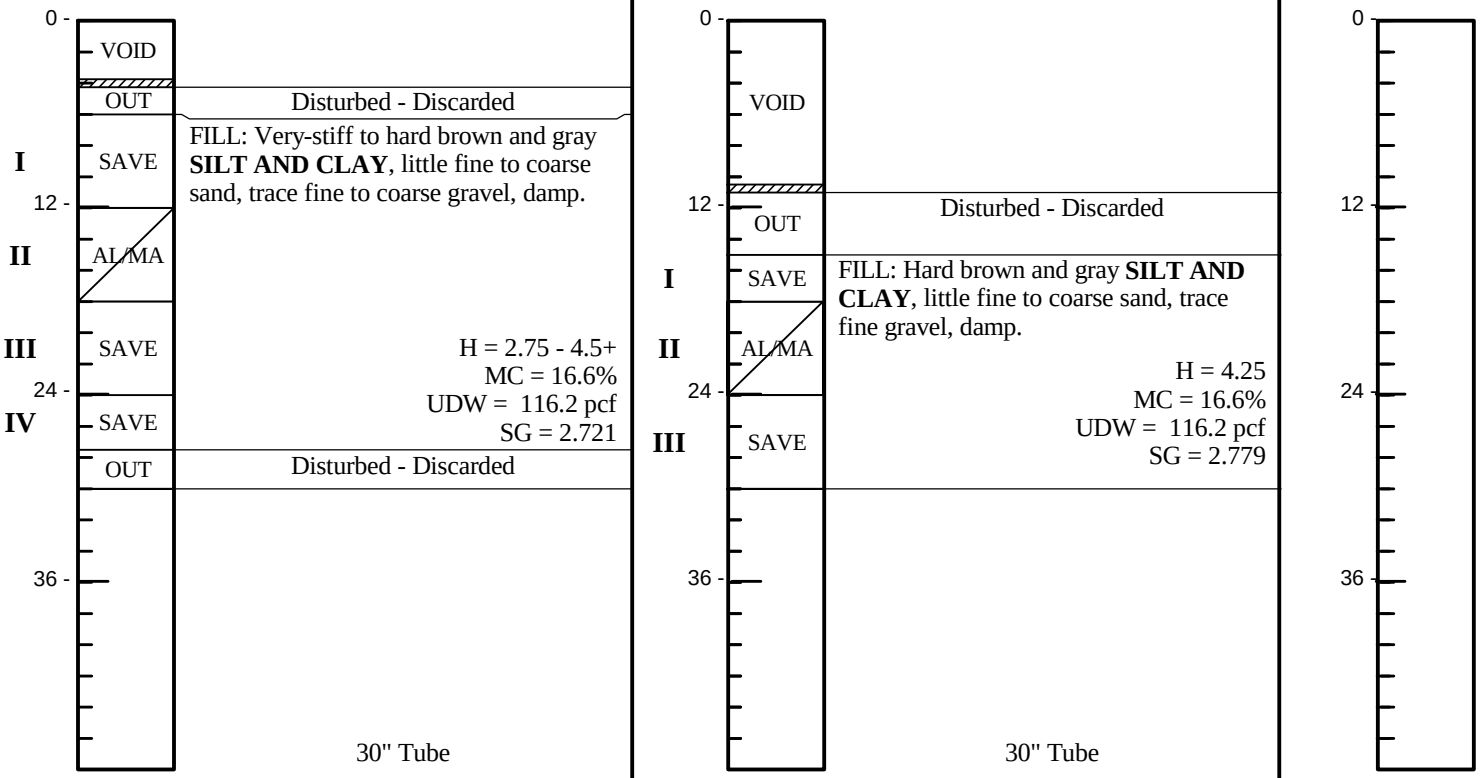
S&ME SHELBY TUBE LOG - OH_DOT.GDT - 6/24/24 15:55 - R:\SERVICE LINES\CS-2557\CLEVELAND\01 - LABORATORY\02 - GINT\WPROJECTS\22170059B-NEW.GPJ

PLATE 46

JOB NUMBER : **22170059B**
PROJECT : **LAK-90-2.93 SLIDE**
PID : **112663**

LABORATORY LOG OF SHELBY TUBES

Boring : **B-008-1-22** Sample : **ST-12**	Boring : **B-008-1-22** Sample : **ST-33**	Boring : Sample :
Depth : **16.5' - 18.5'** Recovery : **21.5"**	Depth : **3.0' - 5.0'** Recovery : **15.0"**	Depth : Recovery :



LEGEND

- Consolidation, Incremental
- Consolidation, C R S
- Permeability, Vertical / Horizontal
- Swelling, Test
- Wax
- Unconfined Compression Test
- Triaxial Compression Test

H - Hand Penetrometer (tsf)
Ds - Direct Shear
LOI - Loss on Ignition
AL - Atterberg Limits
MA - Sieve/Hydrometer
SG - Specific Gravity
TV - Torvane (tsf)
POR - Porosity
UDW - Unit Dry Weight
MC - Moisture Content
D_R - Relative Density
S - Sieve

S&ME SHELBY TUBE LOG - OH_DOT.GDT - 6/24/24 15:55 - R:\SERVICE LINES\CS-2557\CLEVELAND\01 - LABORATORY\02 - GINT\WPROJECTS\22170059B-NEW.GPJ

PLATE 47

WILDCAT DYNAMIC CONE LOG

PROJECT NUMBER: 22170059B
DATE STARTED: 02-02-2023
DATE COMPLETED: 02-02-2023

HOLE #: D-007-1-22
CREW: A. Khan, K. Harper, B. Sears
PROJECT: LAK-90-2.93 Landslide
ADDRESS: IR 90 & SR 91 On-ramp
LOCATION: Sta. 110+16, 282.1' Lt.

SURFACE ELEVATION: 693
WATER ON COMPLETION: Dry
HAMMER WEIGHT: 35 lbs.
CONE AREA: 10 sq. cm

DEPTH	BLOWS PER 10 cm	RESISTANCE Kg/cm²	GRAPH OF CONE RESISTANCE 0 50 100 150	N'	TESTED CONSISTENCY NON-COHESIVE	TESTED CONSISTENCY COHESIVE
-	20	88.8	••••••••••••••••••••••••	25	MEDIUM DENSE	VERY STIFF
-	20	88.8	••••••••••••••••••••••••	25	MEDIUM DENSE	VERY STIFF
- 1 ft	3	13.3	•••	3	VERY LOOSE	SOFT
-	3	13.3	•••	3	VERY LOOSE	SOFT
-	6	26.6	•••••••	7	LOOSE	MEDIUM STIFF
- 2 ft	5	22.2	••••••	6	LOOSE	MEDIUM STIFF
-	10	44.4	••••••••••••	12	MEDIUM DENSE	STIFF
-	4	17.8	•••••	5	LOOSE	MEDIUM STIFF
- 3 ft	5	22.2	••••••	6	LOOSE	MEDIUM STIFF
- 1 m	5	22.2	••••••	6	LOOSE	MEDIUM STIFF
-	5	19.3	•••••	5	LOOSE	MEDIUM STIFF
- 4 ft	3	11.6	•••	3	VERY LOOSE	SOFT
-	5	19.3	•••••	5	LOOSE	MEDIUM STIFF
-	6	23.2	••••••	6	LOOSE	MEDIUM STIFF
- 5 ft	8	30.9	••••••••	8	LOOSE	MEDIUM STIFF
-	6	23.2	••••••	6	LOOSE	MEDIUM STIFF
-	10	38.6	••••••••••••	11	MEDIUM DENSE	STIFF
- 6 ft	9	34.7	•••••••••	9	LOOSE	STIFF
-	11	42.5	••••••••••••	12	MEDIUM DENSE	STIFF
- 2 m	13	50.2	••••••••••••••	14	MEDIUM DENSE	STIFF
- 7 ft	32	109.4	••••••••••••••••••••••••••••••	25+	DENSE	HARD
-	50	171.0	••	25+	DENSE	HARD
-						
- 8 ft						
-						
-						
- 9 ft						
-						
-						
- 3 m 10 ft						
-						
-						
-						
- 11 ft						
-						
-						
- 12 ft						
-						
-						
- 4 m 13 ft						

WILDCAT DYNAMIC CONE LOG

PROJECT NUMBER: 22170059B
DATE STARTED: 02-02-2023
DATE COMPLETED: 02-02-2023

HOLE #: D-008-2-22
CREW: A. Khan, K. Harper, B. Sears
PROJECT: LAK-90-2.93 Landslide
ADDRESS: IR 90 & SR 91 On-ramp
LOCATION: Sta. 112+20, 259.6' Lt.

SURFACE ELEVATION: 700
WATER ON COMPLETION: Dry
HAMMER WEIGHT: 35 lbs.
CONE AREA: 10 sq. cm

DEPTH	BLOWS PER 10 cm	RESISTANCE Kg/cm²	GRAPH OF CONE RESISTANCE 0 50 100 150	N'	TESTED CONSISTENCY NON-COHESIVE	COHESIVE
-	2	8.9	••	2	VERY LOOSE	SOFT
-	2	8.9	••	2	VERY LOOSE	SOFT
- 1 ft	2	8.9	••	2	VERY LOOSE	SOFT
-	2	8.9	••	2	VERY LOOSE	SOFT
-	3	13.3	•••	3	VERY LOOSE	SOFT
- 2 ft	1	4.4	•	1	VERY LOOSE	VERY SOFT
-	1	4.4	•	1	VERY LOOSE	VERY SOFT
-	3	13.3	•••	3	VERY LOOSE	SOFT
- 3 ft	6	26.6	•••••••	7	LOOSE	MEDIUM STIFF
- 1 m	7	31.1	•••••••••	8	LOOSE	MEDIUM STIFF
-	8	30.9	••••••••	8	LOOSE	MEDIUM STIFF
- 4 ft	8	30.9	••••••••	8	LOOSE	MEDIUM STIFF
-	12	46.3	••••••••••••	13	MEDIUM DENSE	STIFF
-	10	38.6	••••••••••	11	MEDIUM DENSE	STIFF
- 5 ft	13	50.2	••••••••••••	14	MEDIUM DENSE	STIFF
-	18	69.5	••••••••••••••••••	19	MEDIUM DENSE	VERY STIFF
-	15	57.9	•••••••••••••••	16	MEDIUM DENSE	VERY STIFF
- 6 ft	15	57.9	•••••••••••••••	16	MEDIUM DENSE	VERY STIFF
-	20	77.2	••••••••••••••••••••	22	MEDIUM DENSE	VERY STIFF
- 2 m	21	81.1	•••••••••••••••••••••	23	MEDIUM DENSE	VERY STIFF
- 7 ft	20	68.4	••••••••••••••••••	19	MEDIUM DENSE	VERY STIFF
-	22	75.2	••••••••••••••••••••	21	MEDIUM DENSE	VERY STIFF
-	22	75.2	••••••••••••••••••••	21	MEDIUM DENSE	VERY STIFF
- 8 ft	28	95.8	•••••••••••••••••••••••••	25+	MEDIUM DENSE	VERY STIFF
-	35	119.7	••••••••••••••••••••••••••••••••••	25+	DENSE	HARD
-	31	106.0	•••••••••••••••••••••••••••••	25+	MEDIUM DENSE	VERY STIFF
- 9 ft	33	112.9	••••••••••••••••••••••••••••••	25+	DENSE	HARD
-	29	99.2	••••••••••••••••••••••••••	25+	MEDIUM DENSE	VERY STIFF
-	25	85.5	•••••••••••••••••••••••	24	MEDIUM DENSE	VERY STIFF
- 3 m 10 ft	21	71.8	••••••••••••••••••••	20	MEDIUM DENSE	VERY STIFF
-	23	70.4	••••••••••••••••••••	20	MEDIUM DENSE	VERY STIFF
-	19	58.1	•••••••••••••••	16	MEDIUM DENSE	VERY STIFF
-	21	64.3	••••••••••••••••••	18	MEDIUM DENSE	VERY STIFF
- 11 ft	20	61.2	•••••••••••••••••	17	MEDIUM DENSE	VERY STIFF
-	20	61.2	•••••••••••••••••	17	MEDIUM DENSE	VERY STIFF
-	23	70.4	••••••••••••••••••••	20	MEDIUM DENSE	VERY STIFF
- 12 ft	22	67.3	••••••••••••••••••••	19	MEDIUM DENSE	VERY STIFF
-	23	70.4	••••••••••••••••••••	20	MEDIUM DENSE	VERY STIFF
-	26	79.6	••••••••••••••••••••••	22	MEDIUM DENSE	VERY STIFF
- 4 m 13 ft	34	104.0	••••••••••••••••••••••••••••••	25+	MEDIUM DENSE	VERY STIFF

PROJECT: LAK-90-2.93 Landslide PROJECT NUMBER: 22170059B

DEPTH	BLOWS PER 10 cm	RESISTANCE Kg/cm²	GRAPH OF CONE RESISTANCE 0 50 100 150	N'	TESTED CONSISTENCY NON-COHESIVE	TESTED CONSISTENCY COHESIVE
-	32	88.6	••••••••••••••••••••••	25	MEDIUM DENSE	VERY STIFF
-	33	91.4	•••••••••••••••••••••••	25+	MEDIUM DENSE	VERY STIFF
- 14 ft	33	91.4	•••••••••••••••••••••••	25+	MEDIUM DENSE	VERY STIFF
-	32	88.6	••••••••••••••••••••••	25	MEDIUM DENSE	VERY STIFF
-	34	94.2	•••••••••••••••••••••••••	25+	MEDIUM DENSE	VERY STIFF
- 15 ft	37	102.5	••••••••••••••••••••••••••••	25+	MEDIUM DENSE	VERY STIFF
-						
-						
- 16 ft						
- 5 m						
-						
- 17 ft						
-						
-						
- 18 ft						
-						
-						
- 19 ft						
-						
- 6 m						
- 20 ft						
-						
-						
- 21 ft						
-						
-						
- 22 ft						
-						
-						
- 7 m 23 ft						
-						
-						
- 24 ft						
-						
-						
- 25 ft						
-						
-						
- 26 ft						
- 8 m						
-						
- 27 ft						
-						
-						
- 28 ft						
-						
-						
- 29 ft						
-						
- 9 m						

PLATE 50

WILDCAT DYNAMIC CONE LOG

PROJECT NUMBER: 22170059B
DATE STARTED: 02-02-2023
DATE COMPLETED: 02-02-2023

HOLE #: D-009-0-22
CREW: A. Khan, K. Harper, B. Sears
PROJECT: LAK-90-2.93 Landslide
ADDRESS: IR 90 & SR 91 On-ramp
LOCATION: Sta. 112+66, 261.4' Lt.

SURFACE ELEVATION: 701
WATER ON COMPLETION: Dry
HAMMER WEIGHT: 35 lbs.
CONE AREA: 10 sq. cm

DEPTH	BLOWS PER 10 cm	RESISTANCE Kg/cm²	GRAPH OF CONE RESISTANCE 0 50 100 150	N'	TESTED CONSISTENCY NON-COHESIVE	COHESIVE
-	0	0.0		0	VERY LOOSE	VERY SOFT
-	4	17.8	•••••	5	LOOSE	MEDIUM STIFF
- 1 ft	4	17.8	•••••	5	LOOSE	MEDIUM STIFF
-	4	17.8	•••••	5	LOOSE	MEDIUM STIFF
-	4	17.8	•••••	5	LOOSE	MEDIUM STIFF
- 2 ft	5	22.2	••••••	6	LOOSE	MEDIUM STIFF
-	5	22.2	••••••	6	LOOSE	MEDIUM STIFF
-	4	17.8	•••••	5	LOOSE	MEDIUM STIFF
- 3 ft	5	22.2	••••••	6	LOOSE	MEDIUM STIFF
- 1 m	4	17.8	•••••	5	LOOSE	MEDIUM STIFF
-	4	15.4	••••	4	VERY LOOSE	SOFT
- 4 ft	6	23.2	••••••	6	LOOSE	MEDIUM STIFF
-	7	27.0	•••••••	7	LOOSE	MEDIUM STIFF
-	11	42.5	••••••••••••	12	MEDIUM DENSE	STIFF
- 5 ft	8	30.9	••••••••	8	LOOSE	MEDIUM STIFF
-	11	42.5	••••••••••••	12	MEDIUM DENSE	STIFF
-	8	30.9	••••••••	8	LOOSE	MEDIUM STIFF
- 6 ft	6	23.2	••••••	6	LOOSE	MEDIUM STIFF
-	7	27.0	•••••••	7	LOOSE	MEDIUM STIFF
- 2 m	6	23.2	••••••	6	LOOSE	MEDIUM STIFF
- 7 ft	9	30.8	••••••••	8	LOOSE	MEDIUM STIFF
-	11	37.6	•••••••••	10	LOOSE	STIFF
-	14	47.9	••••••••••••	13	MEDIUM DENSE	STIFF
- 8 ft	23	78.7	••••••••••••••••••••	22	MEDIUM DENSE	VERY STIFF
-	23	78.7	••••••••••••••••••••	22	MEDIUM DENSE	VERY STIFF
-	24	82.1	•••••••••••••••••••••	23	MEDIUM DENSE	VERY STIFF
- 9 ft	35	119.7	••••••••••••••••••••••••••••••••••	25+	DENSE	HARD
-	33	112.9	••••••••••••••••••••••••••••••••	25+	DENSE	HARD
-	36	123.1	••••••••••••••••••••••••••••••••••	25+	DENSE	HARD
- 3 m 10 ft	31	106.0	•••••••••••••••••••••••••••	25+	MEDIUM DENSE	VERY STIFF
-	31	94.9	•••••••••••••••••••••••••	25+	MEDIUM DENSE	VERY STIFF
-	35	107.1	•••••••••••••••••••••••••••••	25+	MEDIUM DENSE	VERY STIFF
-	42	128.5	••••••••••••••••••••••••••••••••••	25+	DENSE	HARD
- 11 ft	45	137.7	••••••••••••••••••••••••••••••••••••	25+	DENSE	HARD
-	51	156.1	••	25+	DENSE	HARD
-	59	180.5	••	25+	VERY DENSE	HARD
- 12 ft	57	174.4	••	25+	DENSE	HARD
-						
-						
- 4 m 13 ft						

PLATE 51

WILDCAT DYNAMIC CONE LOG

PROJECT NUMBER: 22170059B
DATE STARTED: 02-02-2023
DATE COMPLETED: 02-02-2023

HOLE #: D-010-1-22
CREW: A. Khan, K. Harper, B. Sears
PROJECT: LAK-90-2.93 Landslide
ADDRESS: IR 90 & SR 91 On-ramp
LOCATION: Sta. 113+20, 330.9' Lt.

SURFACE ELEVATION: 697
WATER ON COMPLETION: Dry
HAMMER WEIGHT: 35 lbs.
CONE AREA: 10 sq. cm

DEPTH	BLOWS PER 10 cm	RESISTANCE Kg/cm²	GRAPH OF CONE RESISTANCE 0 50 100 150	N'	TESTED CONSISTENCY NON-COHESIVE	COHESIVE
-	0	0.0		0	VERY LOOSE	VERY SOFT
-	1	4.4	•	1	VERY LOOSE	VERY SOFT
- 1 ft	3	13.3	•••	3	VERY LOOSE	SOFT
-	4	17.8	•••••	5	LOOSE	MEDIUM STIFF
-	4	17.8	•••••	5	LOOSE	MEDIUM STIFF
- 2 ft	4	17.8	•••••	5	LOOSE	MEDIUM STIFF
-	3	13.3	•••	3	VERY LOOSE	SOFT
-	5	22.2	••••••	6	LOOSE	MEDIUM STIFF
- 3 ft	5	22.2	••••••	6	LOOSE	MEDIUM STIFF
- 1 m	7	31.1	•••••••••	8	LOOSE	MEDIUM STIFF
-	14	54.0	••••••••••••••	15	MEDIUM DENSE	STIFF
- 4 ft	15	57.9	•••••••••••••••	16	MEDIUM DENSE	VERY STIFF
-	9	34.7	•••••••••	9	LOOSE	STIFF
-	10	38.6	••••••••••	11	MEDIUM DENSE	STIFF
- 5 ft	10	38.6	••••••••••	11	MEDIUM DENSE	STIFF
-	10	38.6	••••••••••	11	MEDIUM DENSE	STIFF
-	10	38.6	••••••••••	11	MEDIUM DENSE	STIFF
- 6 ft	12	46.3	••••••••••••	13	MEDIUM DENSE	STIFF
-	9	34.7	•••••••••	9	LOOSE	STIFF
- 2 m	10	38.6	••••••••••	11	MEDIUM DENSE	STIFF
- 7 ft	8	27.4	•••••••	7	LOOSE	MEDIUM STIFF
-	11	37.6	•••••••••	10	LOOSE	STIFF
-	12	41.0	••••••••••	11	MEDIUM DENSE	STIFF
- 8 ft	15	51.3	••••••••••••••	14	MEDIUM DENSE	STIFF
-	10	34.2	•••••••••	9	LOOSE	STIFF
-	9	30.8	••••••••	8	LOOSE	MEDIUM STIFF
- 9 ft	9	30.8	••••••••	8	LOOSE	MEDIUM STIFF
-	8	27.4	•••••••	7	LOOSE	MEDIUM STIFF
-	8	27.4	•••••••	7	LOOSE	MEDIUM STIFF
- 3 m 10 ft	10	34.2	•••••••••	9	LOOSE	STIFF
-	8	24.5	•••••••	6	LOOSE	MEDIUM STIFF
-	7	21.4	••••••	6	LOOSE	MEDIUM STIFF
-	7	21.4	••••••	6	LOOSE	MEDIUM STIFF
- 11 ft	7	21.4	••••••	6	LOOSE	MEDIUM STIFF
-	7	21.4	••••••	6	LOOSE	MEDIUM STIFF
-	10	30.6	••••••••	8	LOOSE	MEDIUM STIFF
- 12 ft	11	33.7	•••••••••	9	LOOSE	STIFF
-	10	30.6	••••••••	8	LOOSE	MEDIUM STIFF
-	15	45.9	••••••••••••••	13	MEDIUM DENSE	STIFF
- 4 m 13 ft	16	49.0	•••••••••••••••	13	MEDIUM DENSE	STIFF

PROJECT: LAK-90-2.93 Landslide PROJECT NUMBER: 22170059B

DEPTH	BLOWS PER 10 cm	RESISTANCE Kg/cm²	GRAPH OF CONE RESISTANCE 0 50 100 150	N'	TESTED CONSISTENCY NON-COHESIVE	TESTED CONSISTENCY COHESIVE
-	27	74.8	••••••••••••••••••••	21	MEDIUM DENSE	VERY STIFF
-	20	55.4	••••••••••••••••	15	MEDIUM DENSE	STIFF
- 14 ft	20	55.4	••••••••••••••••	15	MEDIUM DENSE	STIFF
-	15	41.6	••••••••••••	11	MEDIUM DENSE	STIFF
-	16	44.3	••••••••••••	12	MEDIUM DENSE	STIFF
- 15 ft	12	33.2	•••••••••	9	LOOSE	STIFF
-	50	138.5	••	25+	DENSE	HARD
-						
- 16 ft						
- 5 m						
-						
- 17 ft						
-						
-						
- 18 ft						
-						
-						
- 19 ft						
-						
- 6 m						
- 20 ft						
-						
-						
- 21 ft						
-						
-						
- 22 ft						
-						
-						
- 7 m 23 ft						
-						
-						
- 24 ft						
-						
-						
- 25 ft						
-						
-						
- 26 ft						
- 8 m						
-						
- 27 ft						
-						
-						
- 28 ft						
-						
-						
- 29 ft						
-						
- 9 m						

WILDCAT DYNAMIC CONE LOG

PROJECT NUMBER: 22170059B
DATE STARTED: 02-02-2023
DATE COMPLETED: 02-02-2023

HOLE #: D-011-0-22
CREW: A. Khan, K. Harper, B. Sears
PROJECT: LAK-90-2.93 Landslide
ADDRESS: IR 90 & SR 91 On-ramp
LOCATION: Sta. 113+33, 322.9' Lt.

SURFACE ELEVATION: 695
WATER ON COMPLETION: Dry
HAMMER WEIGHT: 35 lbs.
CONE AREA: 10 sq. cm

DEPTH	BLOWS PER 10 cm	RESISTANCE Kg/cm²	GRAPH OF CONE RESISTANCE 0 50 100 150	N'	TESTED CONSISTENCY NON-COHESIVE	COHESIVE
-	2	8.9	••	2	VERY LOOSE	SOFT
-	3	13.3	•••	3	VERY LOOSE	SOFT
- 1 ft	3	13.3	•••	3	VERY LOOSE	SOFT
-	3	13.3	•••	3	VERY LOOSE	SOFT
-	3	13.3	•••	3	VERY LOOSE	SOFT
- 2 ft	3	13.3	•••	3	VERY LOOSE	SOFT
-	4	17.8	•••••	5	LOOSE	MEDIUM STIFF
-	3	13.3	•••	3	VERY LOOSE	SOFT
- 3 ft	4	17.8	•••••	5	LOOSE	MEDIUM STIFF
- 1 m	6	26.6	•••••••	7	LOOSE	MEDIUM STIFF
-	7	27.0	•••••••	7	LOOSE	MEDIUM STIFF
- 4 ft	19	73.3	••••••••••••••••••••	20	MEDIUM DENSE	VERY STIFF
-	14	54.0	••••••••••••••	15	MEDIUM DENSE	STIFF
-	15	57.9	•••••••••••••••	16	MEDIUM DENSE	VERY STIFF
- 5 ft	13	50.2	•••••••••••••	14	MEDIUM DENSE	STIFF
-	13	50.2	•••••••••••••	14	MEDIUM DENSE	STIFF
-	15	57.9	•••••••••••••••	16	MEDIUM DENSE	VERY STIFF
- 6 ft	14	54.0	••••••••••••••	15	MEDIUM DENSE	STIFF
-	14	54.0	••••••••••••••	15	MEDIUM DENSE	STIFF
- 2 m	36	139.0	••	25+	DENSE	HARD
- 7 ft	22	75.2	••••••••••••••••••••	21	MEDIUM DENSE	VERY STIFF
-	23	78.7	•••••••••••••••••••••	22	MEDIUM DENSE	VERY STIFF
-	20	68.4	••••••••••••••••••	19	MEDIUM DENSE	VERY STIFF
- 8 ft	22	75.2	••••••••••••••••••••	21	MEDIUM DENSE	VERY STIFF
-	22	75.2	••••••••••••••••••••	21	MEDIUM DENSE	VERY STIFF
-	22	75.2	••••••••••••••••••••	21	MEDIUM DENSE	VERY STIFF
- 9 ft	19	65.0	••••••••••••••••••	18	MEDIUM DENSE	VERY STIFF
-	21	71.8	•••••••••••••••••••	20	MEDIUM DENSE	VERY STIFF
-	28	95.8	••••••••••••••••••••••••••	25+	MEDIUM DENSE	VERY STIFF
- 3 m 10 ft	23	78.7	••••••••••••••••••••••	22	MEDIUM DENSE	VERY STIFF
-	26	79.6	••••••••••••••••••••••••	22	MEDIUM DENSE	VERY STIFF
-	26	79.6	••••••••••••••••••••••••	22	MEDIUM DENSE	VERY STIFF
-	36	110.2	••••••••••••••••••••••••••••••	25+	DENSE	HARD
- 11 ft	33	101.0	•••••••••••••••••••••••••••	25+	MEDIUM DENSE	VERY STIFF
-	34	104.0	••••••••••••••••••••••••••••	25+	MEDIUM DENSE	VERY STIFF
-	36	110.2	••••••••••••••••••••••••••••••	25+	DENSE	HARD
- 12 ft	38	116.3	••••••••••••••••••••••••••••••••	25+	DENSE	HARD
-	36	110.2	••••••••••••••••••••••••••••••	25+	DENSE	HARD
-	36	110.2	••••••••••••••••••••••••••••••	25+	DENSE	HARD
- 4 m 13 ft	37	113.2	••••••••••••••••••••••••••••••••	25+	DENSE	HARD

PROJECT: LAK-90-2.93 Landslide PROJECT NUMBER: 22170059B

DEPTH	BLOWS PER 10 cm	RESISTANCE Kg/cm²	GRAPH OF CONE RESISTANCE 0 50 100 150	N'	TESTED CONSISTENCY NON-COHESIVE	TESTED CONSISTENCY COHESIVE
-	41	113.6	••••••••••••••••••••••••••••••	25+	DENSE	HARD
-	41	113.6	••••••••••••••••••••••••••••••	25+	DENSE	HARD
- 14 ft	41	113.6	••••••••••••••••••••••••••••••	25+	DENSE	HARD
-	42	116.3	••••••••••••••••••••••••••••••••	25+	DENSE	HARD
-	42	116.3	••••••••••••••••••••••••••••••••	25+	DENSE	HARD
- 15 ft						
-						
-						
- 16 ft						
- 5 m						
-						
- 17 ft						
-						
-						
- 18 ft						
-						
-						
- 19 ft						
-						
- 6 m						
- 20 ft						
-						
-						
- 21 ft						
-						
-						
- 22 ft						
-						
-						
- 7 m 23 ft						
-						
-						
- 24 ft						
-						
-						
- 25 ft						
-						
-						
- 26 ft						
- 8 m						
-						
- 27 ft						
-						
-						
- 28 ft						
-						
-						
- 29 ft						
-						
- 9 m						

B-001-0-22

Run #:	Depth		Recovery		RQD	
NQ-9	14.0’	19.0’	59/60	98%	16/60	27%
NQ-10	19.0’	24.2’	58/62	94%	19/62	31%
LAK-90-2.93 PID 112663						

B-001-1-22

Run #:	Depth		Recovery		RQD	
NQ-9	15.0’	19.5’	52/54	96%	20/54	37%
NQ-10	19.5’	25.1’	65/67	97%	30/67	45%
LAK-90-2.93 PID 112663						

B-002-0-22

Run #:	Depth		Recovery		RQD	
NQ-40	67.0'	72.0'	60/60	100%	46/60	77%
NQ-41	72.0'	77.0'	60/60	100%	46/60	77%
LAK-90-2.93 PID 112663						

B-005-1-23

Run #:	Depth		Recovery		RQD	
NQ-5	44.2'	49.2'	44/60	73%	31/60	52%
NQ-6	49.2'	54.2'	60/60	100%	45/60	75%
NQ-7	54.2'	59.4'	62/62	100%	21/60	34%
NQ-8	59.4'	64.4'	54/60	90%	45/60	75%
LAK-90-2.93 PID 112663						

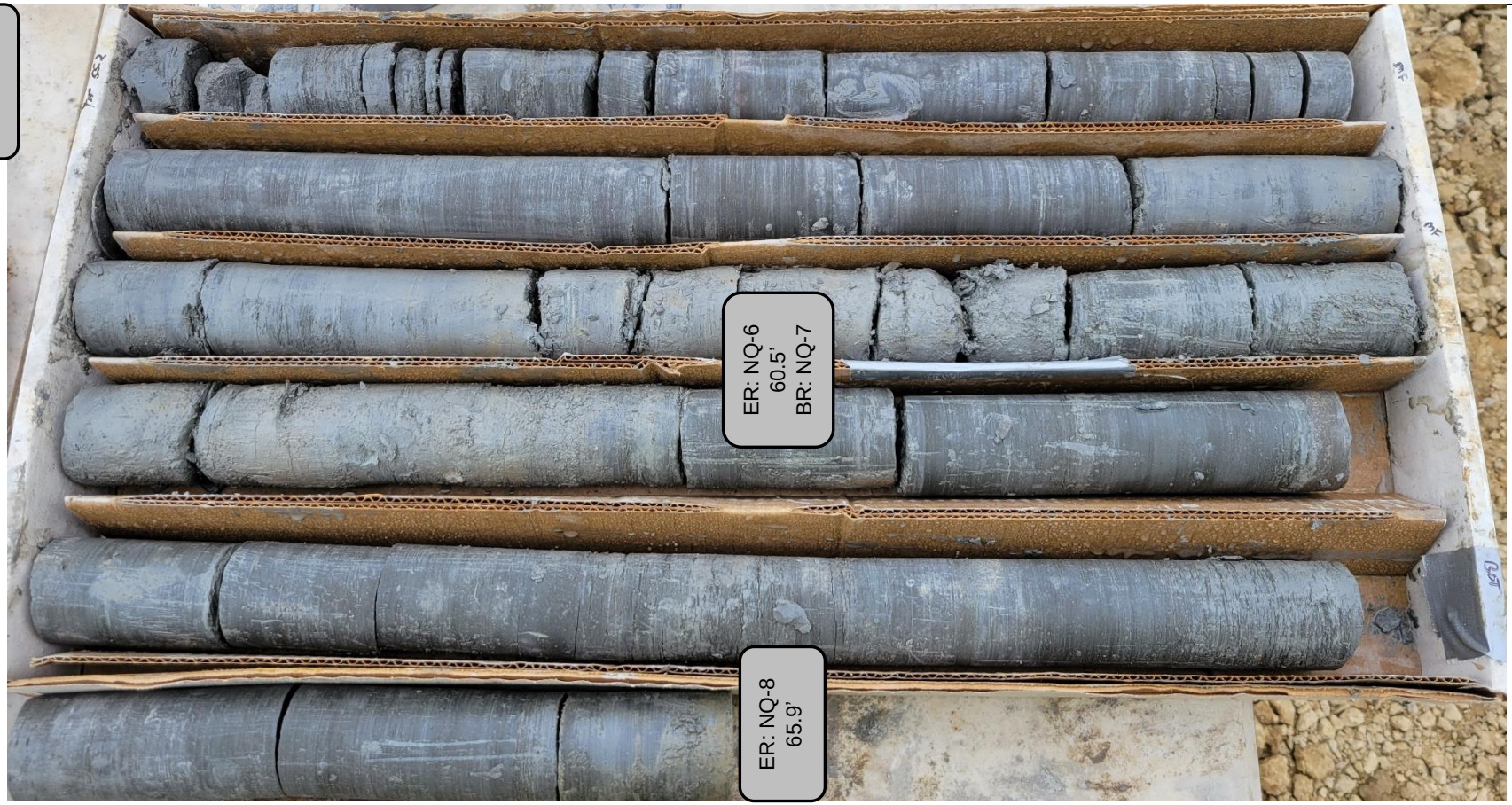
B-005-1-23

Run #:	Depth		Recovery		RQD	
NQ-5	44.2'	49.2'	44/60	73%	31/60	52%
NQ-6	49.2'	54.2'	60/60	100%	45/60	75%
NQ-7	54.2'	59.4'	62/62	100%	21/60	34%
NQ-8	59.4'	64.4'	54/60	90%	45/60	75%
LAK-90-2.93 PID 112663						

B-007-3-23

Run #:	Depth		Recovery		RQD	
NQ-4	45.0'	50.0'	53/60	88%	18/60	30%
NQ-5	50.0'	55.2'	62/62	100%	41/62	66%
NQ-6	55.2'	60.5'	63.5/63.5	100%	35/63.5	55%
NQ-7	60.5'	65.9'	65/65	100%	44/65	68%
LAK-90-2.93 PID 112663						

B-007-3-23



Run #:	Depth		Recovery		RQD	
NQ-4	45.0’	50.0’	53/60	88%	18/60	30%
NQ-5	50.0’	55.2’	62/62	100%	41/62	66%
NQ-6	55.2’	60.5’	63.5/63.5	100%	35/63.5	55%
NQ-7	60.5’	65.9’	65/65	100%	44/65	68%
LAK-90-2.93 PID 112663						

B-007-4-23

Run #:	Depth		Recovery		RQD	
NQ-21	49.2'	54.2'	56/60	93%	13/60	22%
NQ-22	54.2'	59.2'	59/60	98%	37/60	62%
NQ-23	59.2'	64.2'	60/60	100%	38/60	63%
NQ-24	64.2'	69.2'	58/60	97%	17/60	28%
LAK-90-2.93 PID 112663						

B-007-4-23

Run #:	Depth		Recovery		RQD	
NQ-21	49.2'	54.2'	56/60	93%	13/60	22%
NQ-22	54.2'	59.2'	59/60	98%	37/60	62%
NQ-23	59.2'	64.2'	60/60	100%	38/60	63%
NQ-24	64.2'	69.2'	58/60	97%	17/60	28%
LAK-90-2.93 PID 112663						

B-008-4-23

Run #:	Depth		Recovery		RQD	
NQ-2	52.0'	57.0'	48/60	80%	0/60	0%
NQ-3	57.0'	62.0'	58/60	97%	8/60	13%
NQ-4	62.0'	67.0'	57/60	95%	9/60	15%
NQ-5	67.0'	72.0'	58/60	97%	38/60	63%
LAK-90-2.93 PID 112663						

B-008-4-23

Run #:	Depth		Recovery		RQD	
NQ-2	52.0'	57.0'	48/60	80%	0/60	0%
NQ-3	57.0'	62.0'	58/60	97%	8/60	13%
NQ-4	62.0'	67.0'	57/60	95%	9/60	15%
NQ-5	67.0'	72.0'	58/60	97%	38/60	63%
LAK-90-2.93 PID 112663						

B-009-1-23

BR: NQ-24
60.0’

ER: NQ-24
70.0’

Run #:	Depth		Recovery		RQD	
NQ-24	60.0’	70.0’	112/120	93%	42/120	35%
NQ-25	70.0’	80.0’	119/120	99%	67/120	56%
LAK-90-2.93 PID 112663						

B-009-1-23

Run #:	Depth		Recovery		RQD	
NQ-24	60.0'	70.0'	112/120	93%	42/120	35%
NQ-25	70.0'	80.0'	119/120	99%	67/120	56%
LAK-90-2.93 PID 112663						

Appendix II – Laboratory Test Results

S&ME, Inc.
8400 Sweet Valley Drive, Suite 404
Valley View, OH 44125
Telephone: 216-901-1000
Fax: 216-901-9996

SUMMARY OF LABORATORY RESULTS

PROJECT 22170059B **PID** 112663

OGE NUMBER LAK-90-2.93 Slide **PROJECT TYPE** LANDSLIDE

Borehole	Top Sample Depth	Water Content (%)	Liquid Limit	Plastic Limit	Plasticity Index	% Coarse Gravel	% Fine Gravel	% Coarse Sand	% Fine Sand	% Silt	% Clay	% Silt/Clay	Class-ification
B-001-0-22	2.5	12											
B-001-0-22	4.0	10											
B-001-0-22	5.3	5											
B-001-0-22	5.5	10											
B-001-0-22	6.0	7											
B-001-0-22	7.0	7	36	23	13	0	13	17	17	35	18	53	A-6a
B-001-0-22	8.5	5											
B-001-0-22	10.0	6											
B-001-0-22	11.5	5											
B-001-0-22	13.0	4											
B-001-1-22	0.0	19	35	20	15	0	9	9	9	36	37	73	A-6a
B-001-1-22	1.5	18											
B-001-1-22	3.0	19											
B-001-1-22	4.5	16											
B-001-1-22	4.8	17											
B-001-1-22	6.5	17	34	21	13	0	21	7	6	36	30	66	A-6a
B-001-1-22	8.5	19											
B-001-1-22	10.0	14	37	21	16	0	7	7	7	43	36	79	A-6b
B-001-1-22	11.5	15											
B-001-1-22	13.0	9											
B-001-1-22	14.5	8											
B-001-2-22	0.3	20											
B-001-2-22	1.5	16											
B-001-2-22	3.0	13	32	18	14	0	14	7	8	35	36	71	A-6a
B-001-2-22	4.5	15											
B-001-2-22	6.0	13											
B-001-2-22	7.5	20	33	21	12	0	15	9	9	35	32	67	A-6a
B-001-2-22	8.3	25	39	23	16	0	2	4	5	43	46	89	A-6b
B-001-2-22	9.0	21											
B-001-2-22	9.5	19											
B-001-2-22	10.5	16	41	20	21	4	11	7	4	31	43	74	A-7-6
B-001-2-22	12.0	14											
B-001-2-22	13.5	14											
B-001-2-22	15.0	16											
B-001-2-22	16.5	11	37	20	17	9	14	7	6	29	35	64	A-6b
B-001-2-22	18.0	14											
B-001-2-22	19.5	21											
B-001-2-22	20.1	18											
B-001-2-22	21.0	15	42	22	20	0	3	3	5	38	51	89	A-7-6
B-001-2-22	22.5	15											
B-001-2-22	24.0	16											
B-001-2-22	25.5	11											
B-002-0-22	1.8	17											

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SUMMARY OF LABORATORY RESULTS

PROJECT 22170059B **PID** 112663

OGE NUMBER LAK-90-2.93 Slide **PROJECT TYPE** LANDSLIDE

Borehole	Top Sample Depth	Water Content (%)	Liquid Limit	Plastic Limit	Plasticity Index	% Coarse Gravel	% Fine Gravel	% Coarse Sand	% Fine Sand	% Silt	% Clay	% Silt/Clay	Class-ification
B-002-0-22	3.0	17											
B-002-0-22	4.5	17	32	19	13	0	6	5	9	39	41	80	A-6a
B-002-0-22	6.0	15											
B-002-0-22	6.7	16											
B-002-0-22	7.5	6											
B-002-0-22	7.8	10											
B-002-0-22	9.0	8											
B-002-0-22	10.5	11	37	22	15	1	30	14	10	22	23	45	A-6a
B-002-0-22	12.0	12											
B-002-0-22	13.5	13	37	22	15	0	17	6	7	36	34	70	A-6a
B-002-0-22	15.0	15											
B-002-0-22	16.5	10	31	19	12	0	35	10	7	28	20	48	A-6a
B-002-0-22	17.6	12											
B-002-0-22	18.0	16											
B-002-0-22	19.5	12											
B-002-0-22	20.0	17											
B-002-0-22	21.0	17	36	20	16	0	17	10	8	30	35	65	A-6b
B-002-0-22	22.5	16											
B-002-0-22	24.0	21											
B-002-0-22	24.5	16											
B-002-0-22	25.5	14	33	17	16	0	3	5	8	40	44	84	A-6b
B-002-0-22	27.0	14											
B-002-0-22	28.5	15											
B-002-0-22	29.7	15											
B-002-0-22	30.0	15											
B-002-0-22	30.3	13											
B-002-0-22	31.5	14	32	19	13	0	4	6	11	37	42	79	A-6a
B-002-0-22	33.0	16											
B-002-0-22	34.5	15											
B-002-0-22	36.0	14											
B-002-0-22	36.2	15	34	18	16	0	6	6	10	37	41	78	A-6b
B-002-0-22	37.5	15											
B-002-0-22	38.7	13											
B-002-0-22	39.0	15											
B-002-0-22	39.7	18											
B-002-0-22	40.5	18	35	20	15	0	2	2	7	40	49	89	A-6a
B-002-0-22	42.0	14											
B-002-0-22	43.5	19											
B-002-0-22	44.0	19											
B-002-0-22	45.0	17	40	22	18	0	2	9	8	34	47	81	A-6b
B-002-0-22	46.5	16											
B-002-0-22	48.0	16											
B-002-0-22	49.5	14											

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SUMMARY OF LABORATORY RESULTS

PROJECT 22170059B **PID** 112663

OGE NUMBER LAK-90-2.93 Slide **PROJECT TYPE** LANDSLIDE

Borehole	Top Sample Depth	Water Content (%)	Liquid Limit	Plastic Limit	Plasticity Index	% Coarse Gravel	% Fine Gravel	% Coarse Sand	% Fine Sand	% Silt	% Clay	% Silt/Clay	Class-ification
B-002-0-22	51.0	14											
B-002-0-22	51.8	16											
B-002-0-22	53.5	11											
B-002-0-22	56.0	13											
B-002-0-22	58.5	11											
B-002-0-22	61.0	15											
B-002-0-22	63.5	4											
B-003-0-22	0.5	17											
B-003-0-22	1.5	13	31	18	13	0	4	3	8	41	44	85	A-6a
B-003-0-22	3.0	15											
B-003-0-22	3.3	15											
B-003-0-22	4.5	12											
B-003-0-22	6.0	2	28	15	13	0	5	5	9	42	39	81	A-6a
B-003-0-22	7.5	13											
B-003-0-22	9.0	13											
B-003-0-22	10.5	14											
B-003-0-22	12.0	10	31	20	11	8	27	9	8	24	24	48	A-6a
B-003-0-22	13.5	15											
B-003-0-22	15.0	12											
B-003-0-22	16.5	15	33	19	14	0	6	7	12	37	38	75	A-6a
B-003-0-22	17.2	17											
B-003-0-22	18.0	27	40	25	15	0	4	5	6	42	43	85	A-6a
B-003-0-22	19.5	43											
B-003-0-22	20.6	20											
B-003-0-22	21.0	21											
B-003-0-22	22.5	20	45	25	20	0	14	8	11	34	33	67	A-7-6
B-003-0-22	24.0	22											
B-003-0-22	25.5	19											
B-003-0-22	27.0	15	26	16	10	0	23	2	2	38	35	73	A-4a
B-003-0-22	27.5	17											
B-003-0-22	28.5	11											
B-003-0-22	30.0	7											
B-003-0-22	31.5	10											
B-004-0-22	0.5	16											
B-004-0-22	1.5	13	31	17	14	0	3	3	8	42	44	86	A-6a
B-004-0-22	3.0	13											
B-004-0-22	4.5	13											
B-004-0-22	6.0	13	29	16	13	0	4	5	10	40	41	81	A-6a
B-004-0-22	7.5	14											
B-004-0-22	9.0	12											
B-004-0-22	10.1	14											
B-004-0-22	10.5	11	29	17	12	0	16	7	9	35	33	68	A-6a
B-004-0-22	12.0	5											

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PROJECT 22170059B **PID** 112663

OGE NUMBER LAK-90-2.93 Slide **PROJECT TYPE** LANDSLIDE

Borehole	Top Sample Depth	Water Content (%)	Liquid Limit	Plastic Limit	Plasticity Index	% Coarse Gravel	% Fine Gravel	% Coarse Sand	% Fine Sand	% Silt	% Clay	% Silt/Clay	Class-ification
B-004-0-22	12.6	15											
B-004-0-22	13.5	13	30	17	13	3	6	7	10	39	35	74	A-6a
B-004-0-22	15.0	3											
B-004-0-22	16.5	8											
B-004-0-22	17.0	15											
B-004-0-22	18.0	15											
B-004-0-22	19.5	2											
B-004-0-22	21.0	16	30	17	13	0	7	7	12	40	34	74	A-6a
B-004-0-22	23.0	17											
B-004-0-22	23.5	28											
B-004-0-22	24.5	23	38	23	15	0	0	0	6	52	42	94	A-6a
B-004-0-22	26.0	23											
B-004-0-22	27.5	24											
B-004-0-22	27.8	10											
B-004-0-22	29.0	13				0	38	33	13	11	5	16	
B-004-0-22	30.5	14											
B-004-0-22	32.0	19											
B-004-0-22	33.5	13											
B-004-0-22	35.0	11											
B-004-0-22	35.7	11											
B-004-0-22	36.5	9											
B-005-0-22	0.3	18											
B-005-0-22	1.5	17	34	19	15	0	11	5	9	36	39	75	A-6a
B-005-0-22	3.0	2											
B-005-0-22	4.5	19											
B-005-0-22	6.0	16	32	18	14	0	9	5	8	38	40	78	A-6a
B-005-0-22	7.5	15											
B-005-0-22	9.0	18											
B-005-0-22	10.5	14											
B-005-0-22	12.0	14											
B-005-0-22	12.5	12	31	18	13	4	17	5	8	35	31	66	A-6a
B-005-0-22	13.5	15											
B-005-0-22	15.0	15	33	19	14	0	10	6	10	38	36	74	A-6a
B-005-0-22	16.5	16											
B-005-0-22	17.1	22	39	21	18	0	2	4	10	36	48	84	A-6b
B-005-0-22	18.0	11											
B-005-0-22	18.7	18											
B-005-0-22	19.5	17	35	20	15	0	10	7	7	42	34	76	A-6a
B-005-0-22	21.0	20											
B-005-0-22	22.5	22											
B-005-0-22	23.2	21	33	21	12	0	10	12	15	38	25	63	A-6a
B-005-0-22	24.0	20											
B-005-0-22	25.5	16	21	18	3	8	27	34	12	13	6	19	A-1-b

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PROJECT 22170059B **PID** 112663

OGE NUMBER LAK-90-2.93 Slide **PROJECT TYPE** LANDSLIDE

Borehole	Top Sample Depth	Water Content (%)	Liquid Limit	Plastic Limit	Plasticity Index	% Coarse Gravel	% Fine Gravel	% Coarse Sand	% Fine Sand	% Silt	% Clay	% Silt/Clay	Class-ification
B-005-0-22	27.0	10											
B-005-0-22	28.5	11											
B-005-0-22	28.9	13											
B-005-0-22	30.0	11											
B-005-0-22	31.5	13											
B-005-0-22	31.9	14	30	19	11	0	33	13	13	25	16	41	A-6a
B-005-0-22	33.0	16											
B-005-0-22	34.5	9											
B-005-1-23	4.0	19											
B-007-0-22	0.0	18	34	19	15	5	5	6	10	34	40	74	A-6a
B-007-0-22	1.5	21											
B-007-0-22	3.0	13											
B-007-0-22	3.4	10	35	20	15	0	27	13	10	27	23	50	A-6a
B-007-0-22	4.5	20											
B-007-0-22	5.1	14											
B-007-0-22	6.0	14	30	17	13	0	3	7	11	41	38	79	A-6a
B-007-0-22	7.5	15											
B-007-0-22	8.0	23											
B-007-0-22	9.0	16	34	19	15	0	4	5	10	40	41	81	A-6a
B-007-0-22	11.0	14											
B-007-0-22	12.5	18											
B-007-0-22	14.0	17											
B-007-0-22	15.5	16											
B-007-0-22	17.0	18											
B-007-0-22	17.4	17											
B-007-0-22	18.5	18	36	19	17	0	3	4	10	41	42	83	A-6b
B-007-0-22	20.5	19											
B-007-0-22	22.0	16											
B-007-0-22	22.5	17											
B-007-0-22	23.5	19											
B-007-0-22	23.8	12	33	21	12	0	14	5	5	48	28	76	A-6a
B-007-0-22	25.0	13											
B-007-0-22	25.4	10											
B-007-0-22	26.5	16	NP	NP	NP	0	34	32	21	9	4	13	A-1-b
B-007-0-22	28.0	13											
B-007-0-22	29.5	12											
B-007-0-22	29.8	26	NP	NP	NP	0	2	1	68	24	5	29	A-3a
B-007-0-22	31.0	23											
B-007-0-22	31.6	14											
B-007-0-22	32.5	13											
B-007-0-22	33.1	12											
B-007-0-22	34.0	10											
B-007-0-22	35.5	10											

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PROJECT 22170059B **PID** 112663

OGE NUMBER LAK-90-2.93 Slide **PROJECT TYPE** LANDSLIDE

Borehole	Top Sample Depth	Water Content (%)	Liquid Limit	Plastic Limit	Plasticity Index	% Coarse Gravel	% Fine Gravel	% Coarse Sand	% Fine Sand	% Silt	% Clay	% Silt/Clay	Class-ification
B-007-3-23	8.0	17											
B-007-4-23	1.0	20											
B-007-4-23	3.5	17	33	19	14	0	7	6	9	39	39	78	A-6a
B-007-4-23	6.0	29											
B-007-4-23	7.0	13											
B-007-4-23	8.5	16											
B-007-4-23	10.5	18	35	20	15	0	9	6	7	35	43	78	A-6a
B-007-4-23	13.5	13											
B-007-4-23	16.0	18											
B-007-4-23	18.5	13											
B-007-4-23	21.0	16											
B-007-4-23	23.5	13	30	17	13	0	6	7	11	39	37	76	A-6a
B-007-4-23	26.0	16											
B-007-4-23	28.5	20											
B-007-4-23	31.0	15											
B-007-4-23	33.5	21	39	24	15	0	1	3	2	57	37	94	A-6a
B-007-4-23	36.0	26											
B-007-4-23	38.0	21	31	19	12	0	5	7	17	43	28	71	A-6a
B-007-4-23	41.0	17											
B-007-4-23	41.5	13											
B-007-4-23	43.5	22	NP	NP	NP	0	19	49	22	8	2	10	A-1-b
B-007-4-23	46.0	15											
B-007-4-23	48.5	18											
B-008-0-22	1.5	12	28	17	11	0	9	10	13	34	34	68	A-6a
B-008-0-22	3.0	17											
B-008-0-22	3.6	10											
B-008-0-22	4.5	6											
B-008-0-22	5.2	17											
B-008-0-22	6.0	18											
B-008-0-22	7.5	17											
B-008-0-22	8.2	17											
B-008-0-22	9.0	16											
B-008-0-22	9.4	13											
B-008-0-22	10.5	18											
B-008-0-22	12.0	10											
B-008-0-22	12.8	18											
B-008-0-22	13.5	11											
B-008-0-22	15.0	14											
B-008-0-22	16.5	16											
B-008-0-22	17.4	15											
B-008-0-22	18.0	14											
B-008-0-22	19.5	13	33	19	14	0	27	8	9	27	29	56	A-6a
B-008-0-22	21.0	10											

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SUMMARY OF LABORATORY RESULTS

PROJECT 22170059B **PID** 112663

OGE NUMBER LAK-90-2.93 Slide **PROJECT TYPE** LANDSLIDE

Borehole	Top Sample Depth	Water Content (%)	Liquid Limit	Plastic Limit	Plasticity Index	% Coarse Gravel	% Fine Gravel	% Coarse Sand	% Fine Sand	% Silt	% Clay	% Silt/Clay	Class-ification
B-008-0-22	21.3	13											
B-008-0-22	22.5	13											
B-008-0-22	23.2	12											
B-008-0-22	24.0	21											
B-008-0-22	25.5	17											
B-008-0-22	26.2	15											
B-008-0-22	27.0	16											
B-008-0-22	28.5	10	35	21	14	0	18	9	10	33	30	63	A-6a
B-008-0-22	30.0	19											
B-008-0-22	31.5	16											
B-008-0-22	33.0	23											
B-008-0-22	34.5	18											
B-008-0-22	36.0	14	33	18	15	0	3	2	8	41	46	87	A-6a
B-008-0-22	37.5	15											
B-008-0-22	39.0	15											
B-008-0-22	40.5	16											
B-008-0-22	42.0	15											
B-008-0-22	43.5	12	33	19	14	0	42	9	8	21	20	41	A-6a
B-008-0-22	44.1	15											
B-008-0-22	45.0	16											
B-008-0-22	46.5	17											
B-008-0-22	48.0	16	33	18	15	0	2	4	9	41	44	85	A-6a
B-008-0-22	49.5	11											
B-008-0-22	50.3	10											
B-008-0-22	51.0	14											
B-008-0-22	52.5	12											
B-008-0-22	53.1	17	31	18	13	0	9	5	19	33	34	67	A-6a
B-008-0-22	54.0	16											
B-008-0-22	55.5	15											
B-008-0-22	57.0	16											
B-008-0-22	57.5	17											
B-008-0-22	58.5	16	33	19	14	0	3	6	11	40	40	80	A-6a
B-008-0-22	60.0	16											
B-008-0-22	63.5	18											
B-008-0-22	68.5	25	36	21	15	0	2	2	16	45	35	80	A-6a
B-008-0-22	73.5	20	NP	NP	NP	0	3	21	60	12	4	16	A-3a
B-008-0-22	77.0	17											
B-008-1-22	0.0	16	36	21	15	0	13	9	8	32	38	70	A-6a
B-008-1-22	1.5	18											
B-008-1-22	3.0	15											
B-008-1-22	3.5	17	33	18	15	0	9	6	9	36	40	76	A-6a
B-008-1-22	4.5	14											
B-008-1-22	6.0	17	35	18	17	0	1	2	6	44	47	91	A-6b

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SUMMARY OF LABORATORY RESULTS

PROJECT 22170059B **PID** 112663

OGE NUMBER LAK-90-2.93 Slide **PROJECT TYPE** LANDSLIDE

Borehole	Top Sample Depth	Water Content (%)	Liquid Limit	Plastic Limit	Plasticity Index	% Coarse Gravel	% Fine Gravel	% Coarse Sand	% Fine Sand	% Silt	% Clay	% Silt/Clay	Class-ification
B-008-1-22	7.5	17											
B-008-1-22	9.0	17											
B-008-1-22	10.5	13											
B-008-1-22	11.3	18											
B-008-1-22	12.0	17	36	18	18	0	2	3	8	44	43	87	A-6b
B-008-1-22	13.5	19											
B-008-1-22	15.0	18											
B-008-1-22	15.5	22											
B-008-1-22	16.5	16	33	19	14	1	9	7	9	37	37	74	A-6a
B-008-1-22	18.7	16											
B-008-1-22	20.2	14											
B-008-1-22	21.3	15											
B-008-1-22	21.7	16											
B-008-1-22	23.2	18	33	18	15	0	4	4	9	40	43	83	A-6a
B-008-1-22	24.7	15											
B-008-1-22	26.2	15											
B-008-1-22	27.7	17											
B-008-1-22	29.2	16	31	18	13	0	4	5	9	39	43	82	A-6a
B-008-1-22	30.7	15											
B-008-1-22	32.2	17											
B-008-1-22	33.7	15											
B-008-1-22	35.2	18	33	19	14	0	4	5	10	40	41	81	A-6a
B-008-1-22	36.7	29											
B-008-1-22	37.5	12											
B-008-1-22	38.2	17											
B-008-1-22	39.7	12											
B-008-1-22	41.2	13	17	16	1	0	40	32	14	10	4	14	A-1-b
B-008-1-22	42.7	14											
B-008-1-22	44.2	16											
B-008-1-22	45.7	16											
B-008-1-22	46.6	8											
B-008-1-22	47.2	11											
B-009-1-23	1.0	16											
B-009-1-23	3.5	10											
B-009-1-23	4.0	18											
B-009-1-23	6.0	14	30	18	12	0	18	9	8	37	28	65	A-6a
B-009-1-23	8.5	18											
B-009-1-23	8.9	11											
B-009-1-23	11.0	15											
B-009-1-23	13.5	11	24	14	10	3	33	10	9	32	13	45	A-4a
B-009-1-23	16.0	10											
B-009-1-23	16.7	13											
B-009-1-23	18.5	15											

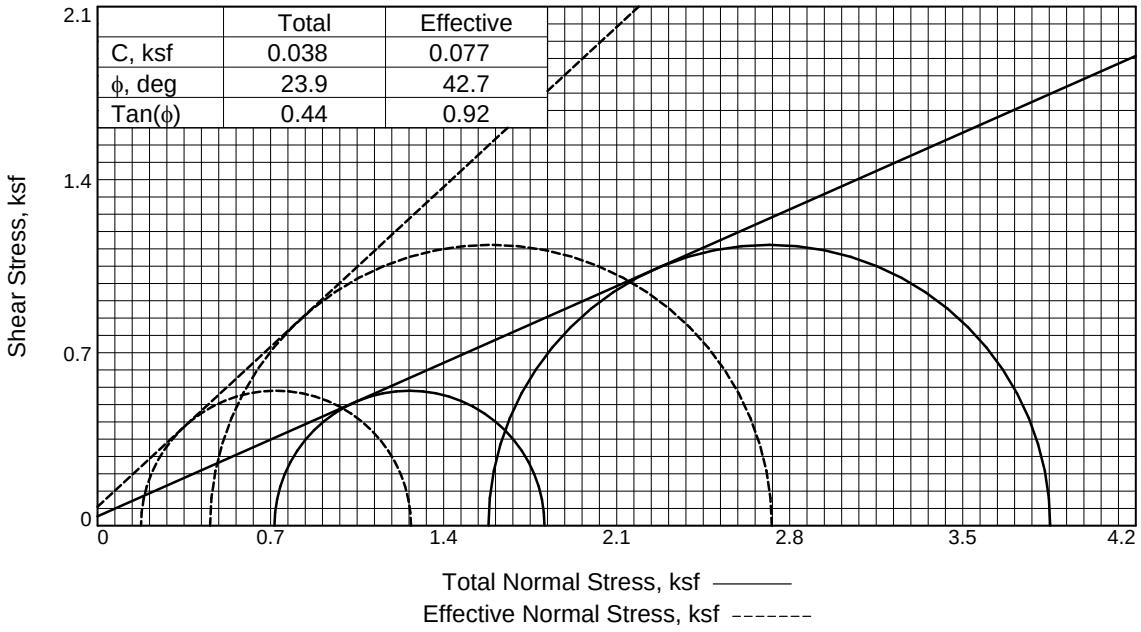
S&ME, Inc.
8400 Sweet Valley Drive, Suite 404
Valley View, OH 44125
Telephone: 216-901-1000
Fax: 216-901-9996

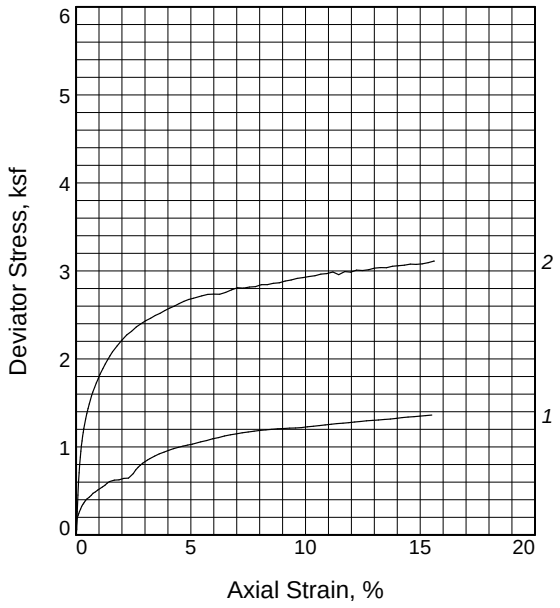
SUMMARY OF LABORATORY RESULTS

PROJECT 22170059B **PID** 112663

OGE NUMBER LAK-90-2.93 Slide **PROJECT TYPE** LANDSLIDE

Borehole	Top Sample Depth	Water Content (%)	Liquid Limit	Plastic Limit	Plasticity Index	% Coarse Gravel	% Fine Gravel	% Coarse Sand	% Fine Sand	% Silt	% Clay	% Silt/Clay	Class-ification
B-009-1-23	18.8	16											
B-009-1-23	21.0	14											
B-009-1-23	23.5	12											
B-009-1-23	24.1	10											
B-009-1-23	26.0	12	29	16	13	0	22	14	5	45	14	59	A-6a
B-009-1-23	28.5	19											
B-009-1-23	31.0	14											
B-009-1-23	33.5	13											
B-009-1-23	38.5	22											
B-009-1-23	41.0	21	35	19	16	3	17	9	8	37	26	63	A-6b
B-009-1-23	43.5	27											
B-009-1-23	46.0	20											
B-009-1-23	46.8	20											
B-009-1-23	48.5	30											
B-009-1-23	48.7	10											
B-009-1-23	51.0	15	NP	NP	NP	0	32	39	16	13	0	13	A-1-b
B-009-1-23	53.5	12											
B-009-1-23	54.1	27											
B-009-1-23	56.0	13											
B-009-1-23	56.3	6											
H-004-1-22	0.0	21	28	17	11	0	30	21	16	19	14	33	A-2-6
H-004-1-22	1.5	23	26	17	9	0	27	26	20	17	10	27	A-2-4
H-004-1-22	3.0	21	35	20	15	4	30	16	7	27	16	43	A-6a
H-004-1-22	4.5	11	23	17	6	13	35	26	11	10	5	15	A-1-b
H-006-0-22	0.0	13				16	49	15	9			11	
H-006-0-22	1.5	50	43	28	15	0	3	4	9	50	34	84	A-7-6
H-006-0-22	3.0	46	38	27	11	0	2	11	23	39	25	64	A-6a
H-006-0-22	4.5	34	35	24	11	0	14	15	18	36	17	53	A-6a
H-007-2-22	0.0	18				16	44	16	7	13	4	17	
H-007-2-22	1.5	22				0	48	26	16			10	
H-007-2-22	3.0	14	25	18	7	3	54	22	6	11	4	15	A-2-4
H-007-2-22	4.5	17	NP	NP	NP	0	29	17	36	14	4	18	A-3a
H-008-3-22	0.0	20				0	26	44	10			20	
H-008-3-22	1.5	14	22	15	7	0	50	26	11	9	4	13	A-2-4
H-008-3-22	3.0	8	NP	NP	NP	16	50	18	9	5	2	7	A-1-a
H-010-0-22	0.0	27	35	19	16	0	14	8	10	34	34	68	A-6b
H-010-0-22	1.5	20	35	20	15	9	14	8	8	31	30	61	A-6a
H-010-0-22	3.0	13	28	17	11	0	29	13	14	27	17	44	A-6a





Sample No.		1	2
Initial	Water Content, %	15.4	13.6
	Dry Density, pcf	117.2	125.8
	Saturation, %	90.1	101.5
	Void Ratio	0.4705	0.3702
	Diameter, in.	2.83	2.87
	Height, in.	5.85	5.99
At Test	Water Content, %	12.0	8.0
	Dry Density, pcf	129.4	141.3
	Saturation, %	100.0	100.0
	Void Ratio	0.3319	0.2198
	Diameter, in.	2.74	2.76
	Height, in.	5.67	5.77
Strain rate, %/min.		0.0058	0.0059
Back Pressure, psi		60.000	60.000
Cell Pressure, psi		64.970	70.980
Fail. Stress, ksf		1.092	2.273
Excess Pore Pr., ksf		0.540	1.126
Ult. Stress, ksf		1.363	3.111
Excess Pore Pr., ksf		0.408	0.643
$\bar{\sigma}_1$ Failure, ksf		1.268	2.728
$\bar{\sigma}_3$ Failure, ksf		0.176	0.455

Type of Test:
CU with Pore Pressures

Sample Type: INTACT

Description: Medium-stiff to stiff gray SILT AND CLAY, some fine gravel, little fine to coarse

LL= 34 **PL=** 21 **PI=** 13

Specific Gravity= 2.761

Remarks: Failure selection based on peak stress ratio. Both sections failed in shear.
ASTM 4767

Figure 1

Client: WSP USA

Project: LAK-90-2.93 Slope Repair

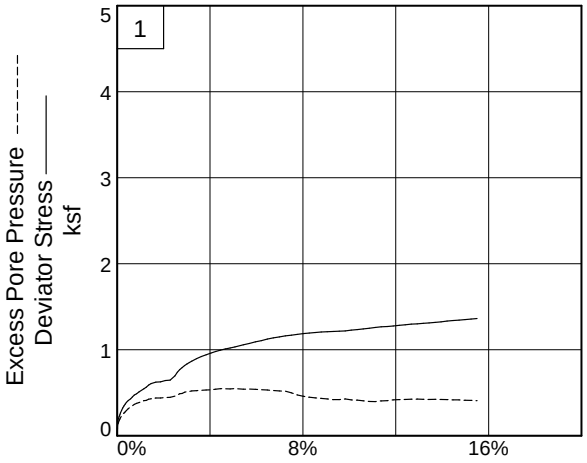
Location: B-001-1-22

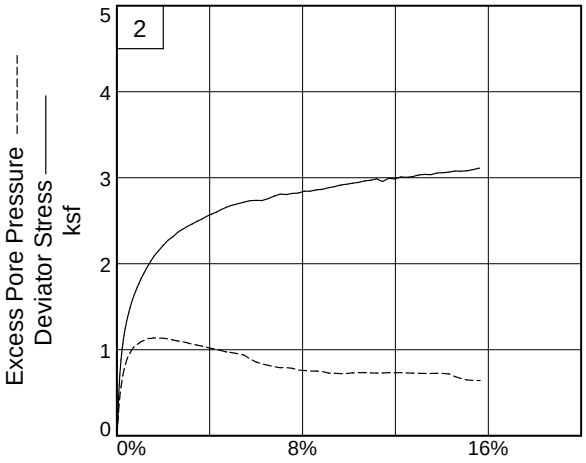
Sample Number: ST-5 **Depth:** 6.5' to 8.5'

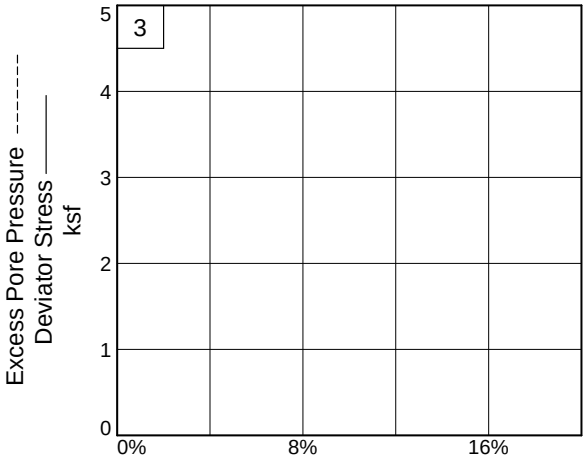
Proj. No.: 22170059B **Date Sampled:** 12/7/2022

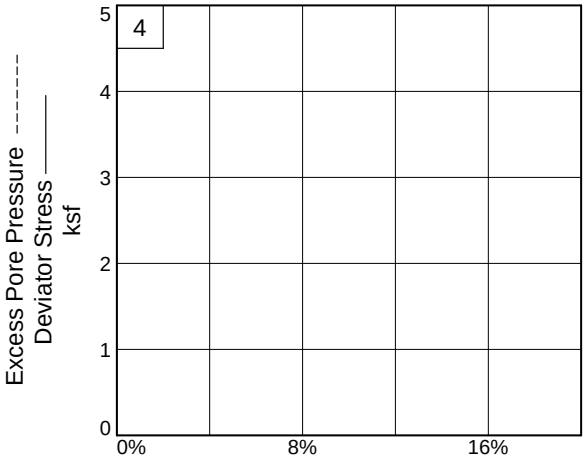
TRIAXIAL SHEAR TEST REPORT
S&ME, Inc.
Valley View, Ohio

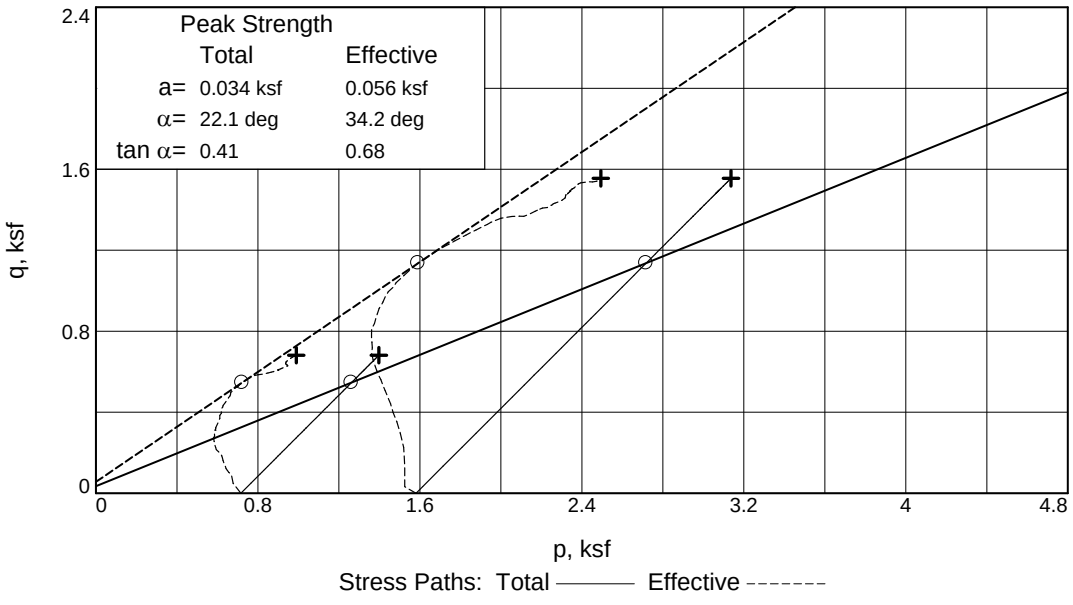
Tested By: CJ









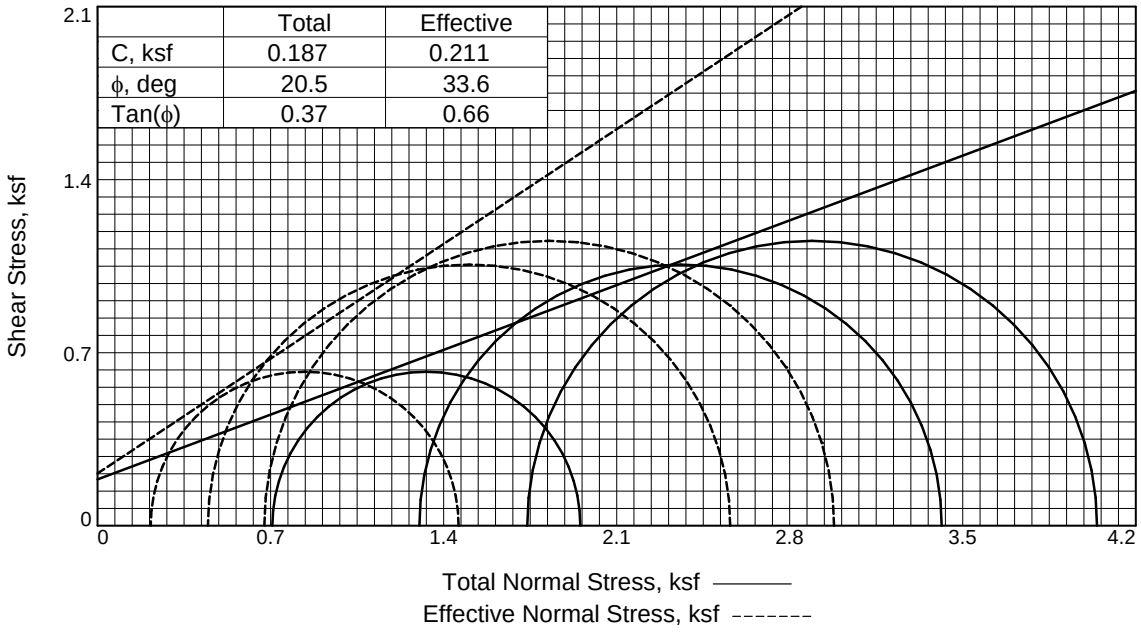


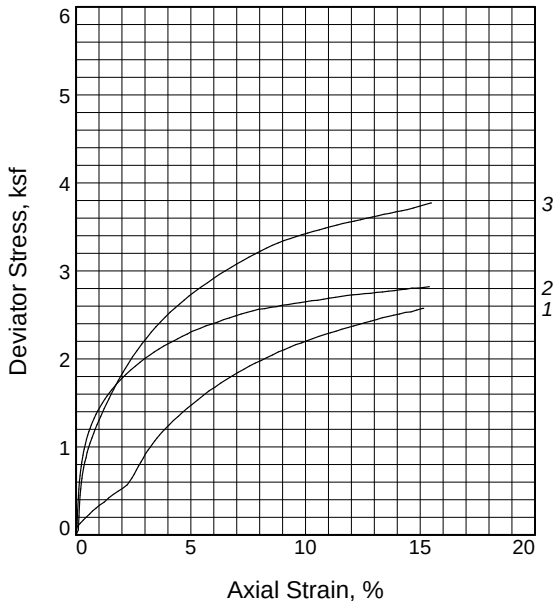
Client: WSP USA
Project: LAK-90-2.93 Slope Repair
Location: B-001-1-22 **Depth:** 6.5' to 8.5' **Sample Number:** ST-5
Project No.: 22170059B **Figure** 2

S&ME, Inc.

Tested By: CJ

C and phi are not test results but an interpretation of the test results. The designer is responsible for interpreting test data as provided by S&ME.





Sample No.		1	2	3
Initial	Water Content, %	16.2	19.5	21.7
	Dry Density, pcf	118.7	107.4	101.3
	Saturation, %	107.9	95.1	90.6
	Void Ratio	0.3984	0.5454	0.6379
	Diameter, in.	2.87	2.86	2.87
	Height, in.	5.92	6.02	5.94
At Test	Water Content, %	14.7	21.3	25.5
	Dry Density, pcf	119.4	106.1	98.9
	Saturation, %	100.0	100.0	100.0
	Void Ratio	0.3906	0.5652	0.6792
	Diameter, in.	2.87	2.91	2.94
	Height, in.	5.88	5.87	5.80
Strain rate, %/min.		0.0092	0.0092	0.0092
Back Pressure, psi		60.000	60.000	60.000
Cell Pressure, psi		64.910	69.040	72.070
Fail. Stress, ksf		1.246	2.113	2.305
Excess Pore Pr., ksf		0.492	0.855	1.064
Ult. Stress, ksf		2.575	2.822	3.771
Excess Pore Pr., ksf		-0.164	0.536	0.234
$\bar{\sigma}_1$ Failure, ksf		1.461	2.559	2.979
$\bar{\sigma}_3$ Failure, ksf		0.215	0.446	0.674

Type of Test:
CU with Pore Pressures

Sample Type: INTACT

Description: Very-stiff gray SILTY CLAY, trace fine to coarse sand, trace fine gravel, moist.

LL= 39 **PL=** 23 **PI=** 16

Specific Gravity= 2.659

Remarks: Failure selection based on peak stress ratio. All specimens failed in shear. ASTM 4767

Figure 1

Client: WSP USA

Project: LAK-90-2.93 Slope Repair

Location: B-001-2-22

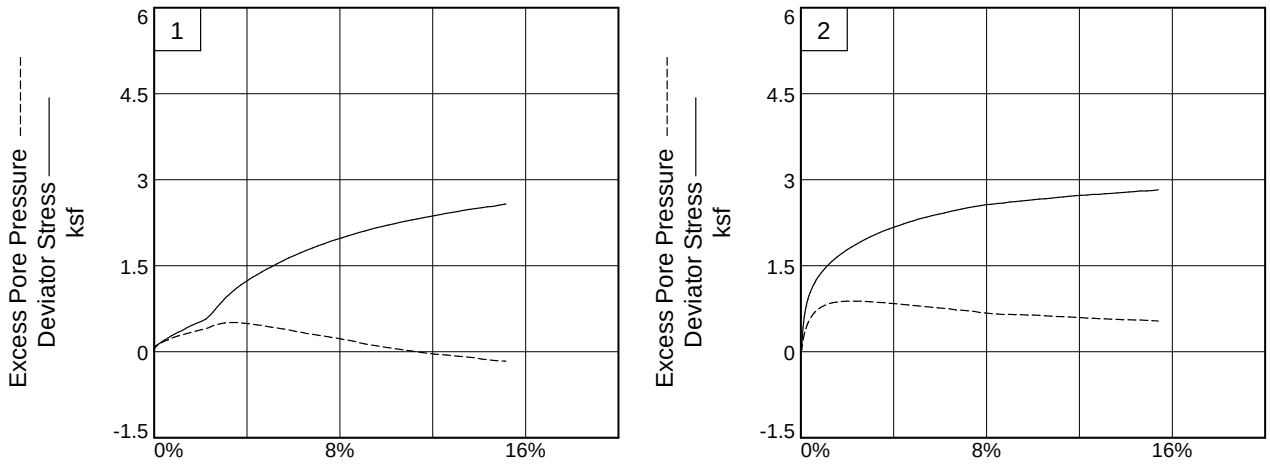
Sample Number: ST-20 **Depth:** 7.5' to 9.5'

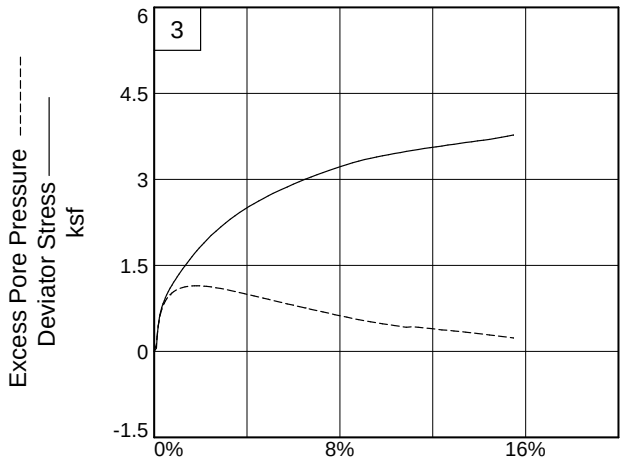
Proj. No.: 22170059B **Date Sampled:** 12/8/2022

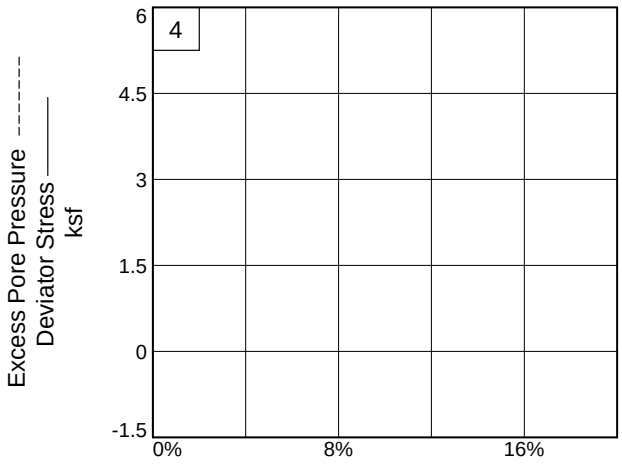
TRIAXIAL SHEAR TEST REPORT
S&ME, Inc.
Valley View, Ohio

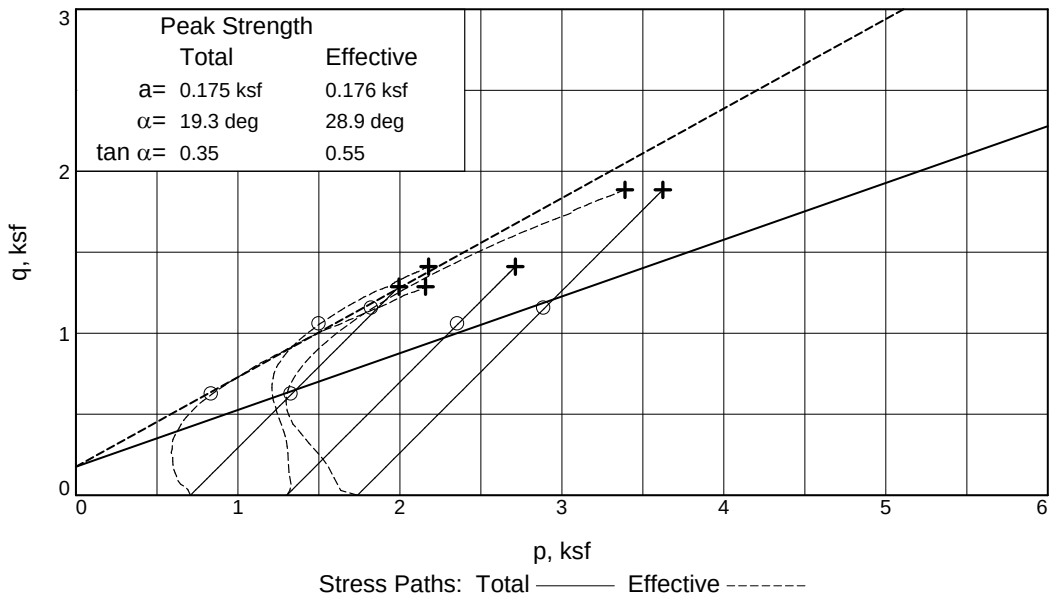
Tested By: CJ **Checked By:** BKS

C and phi are not test results but an interpretation of the test results. The designer is responsible for interpreting test data as provided by S&ME.





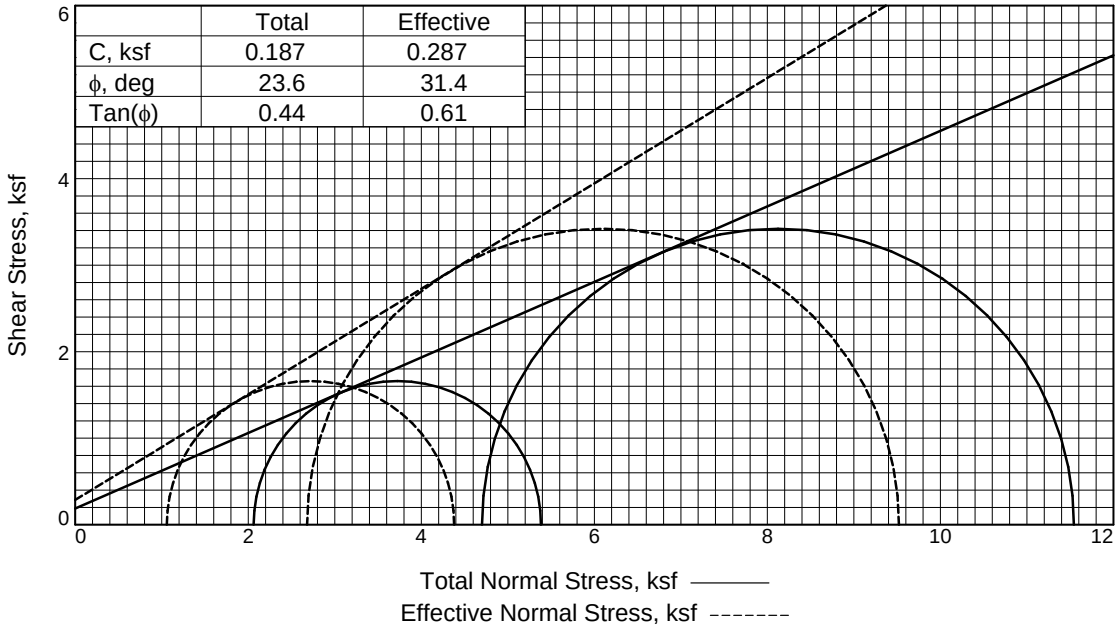


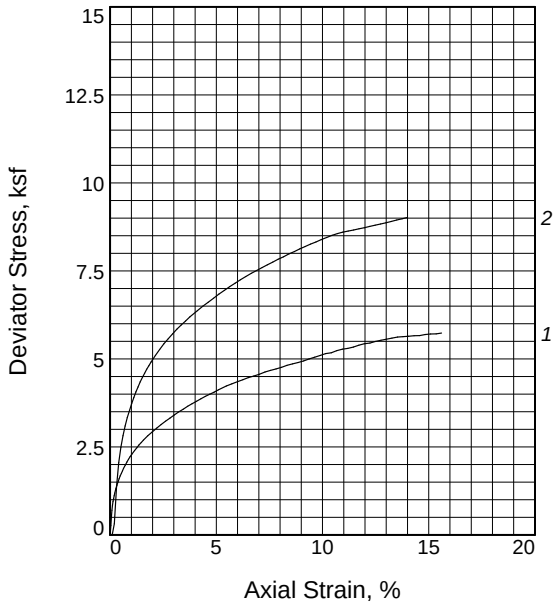


Client: WSP USA
Project: LAK-90-2.93 Slope Repair
Location: B-001-2-22 **Depth:** 7.5' to 9.5' **Sample Number:** ST-20
Project No.: 22170059B **Figure** 2

S&ME, Inc.

Tested By: CJ **Checked By:** BKS





Sample No.		1	2
Initial	Water Content, %	15.1	18.4
	Dry Density, pcf	119.4	115.9
	Saturation, %	97.9	108.3
	Void Ratio	0.4169	0.4596
	Diameter, in.	2.86	2.87
	Height, in.	5.88	6.03
At Test	Water Content, %	9.4	14.7
	Dry Density, pcf	134.7	120.9
	Saturation, %	100.0	100.0
	Void Ratio	0.2558	0.3984
	Diameter, in.	2.75	2.83
	Height, in.	5.65	5.94
Strain rate, %/min.		0.0052	0.0050
Back Pressure, psi		60.000	60.000
Cell Pressure, psi		74.320	92.650
Fail. Stress, ksf		3.321	6.841
Excess Pore Pr., ksf		1.003	2.022
Ult. Stress, ksf		5.735	9.019
Excess Pore Pr., ksf		-0.306	0.610
$\bar{\sigma}_1$ Failure, ksf		4.380	9.521
$\bar{\sigma}_3$ Failure, ksf		1.059	2.680

Type of Test:
CU with Pore Pressures

Sample Type: INTACT

Description: Very-stiff dark gray and brown SILT AND CLAY, little fine to coarse sand, trace fine

LL= 30 **PL=** 17 **PI=** 13

Specific Gravity= 2.709

Remarks: Failure selection based on peak stress ratio. Specimen I failed in bulge and Specimen II failed in shear.

ASTM 4767

Figure 1

Client: WSP USA

Project: LAK-90-2.93 Slope Repair

Location: B-004-0-22

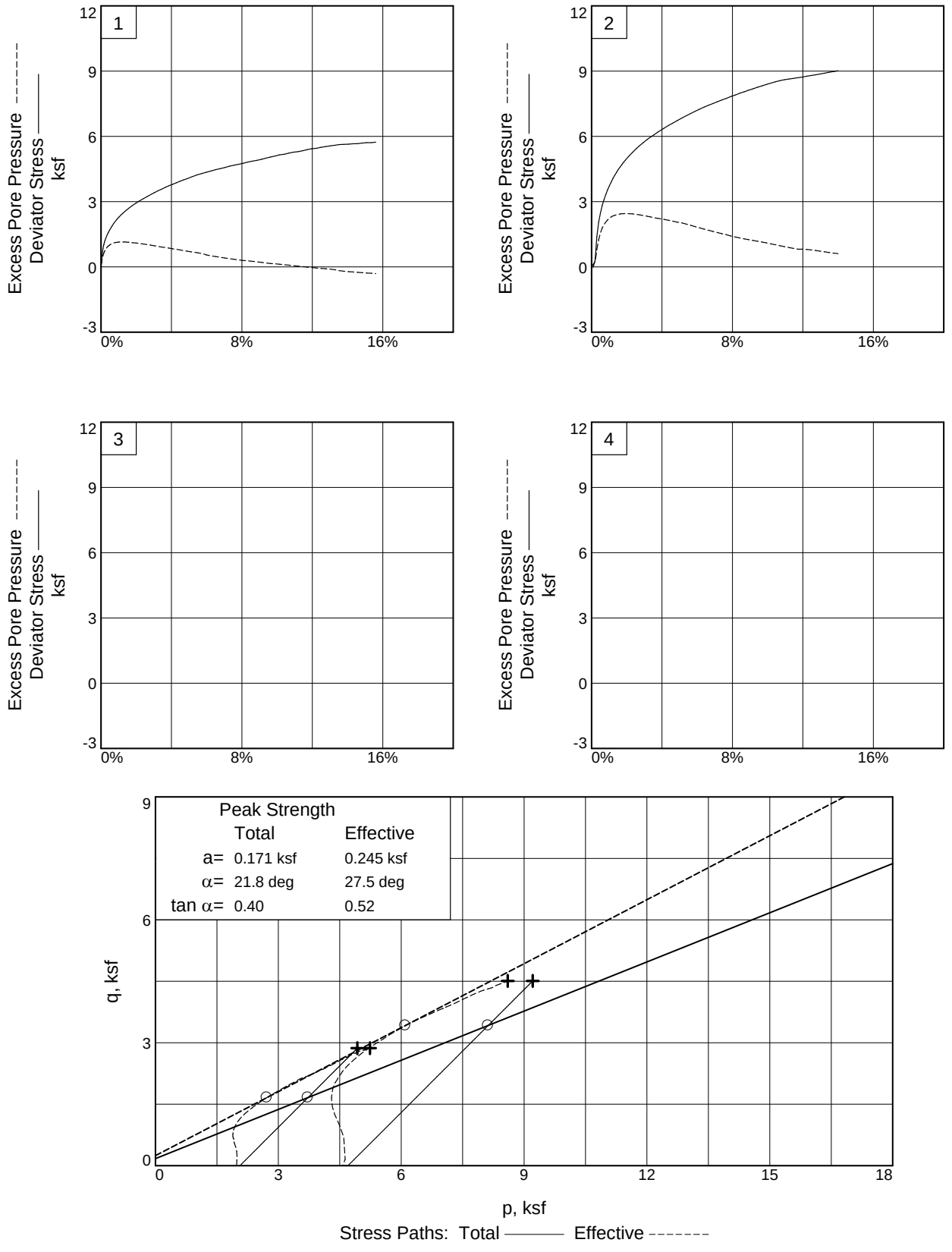
Sample Number: ST-15 **Depth:** 21.0' to 23.0'

Proj. No.: 22170059B **Date Sampled:** 12/9/2022

TRIAXIAL SHEAR TEST REPORT
S&ME, Inc.
Valley View, Ohio

Tested By: CJ **Checked By:** BKS

C and phi are not test results but an interpretation of the test results. The designer is responsible for interpreting test data as provided by S&ME.



Client: WSP USA

Project: LAK-90-2.93 Slope Repair

Location: B-004-0-22 **Depth:** 21.0' to 23.0' **Sample Number:** ST-15

Project No.: 22170059B **Figure** 2

S&ME, Inc.

Tested By: CJ **Checked By:** BKS

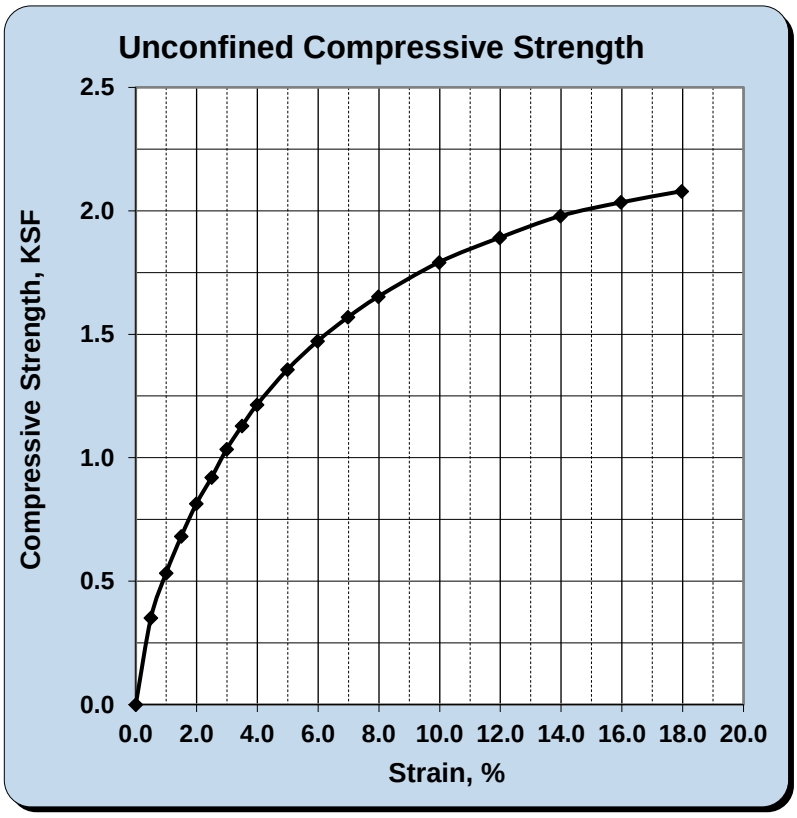
Form No. TR-D2166-01
Revision No. : 1
Revision Date: 08/16/17

UNCONFINED COMPRESSIVE STRENGTH OF COHESIVE SOILS

ASTM D2166

S&ME, Inc. - Columbus: 6190 Enterprise Court, Dublin, Ohio 43016

Project No.:	22170059B	Report Date:	6/6/2024
Project Name:	LAK-90-2.93 Slope Repair	Test Date(s):	5/29/2024
Client Name:	WSP USA Inc.		
Client Address:	2 Miranova Place, Suite 450, Columbus, OH 43215		
Boring No.:	B-005-1-23 Sample No. ST-1		
		Depth:	4.0-6.0
Sample Description:	Visual ID: SILT AND CLAY (A-6a), little fine to coarse sand, trace fine gravel.		



Failed Specimen

Type of Sample: Intact
Source of Moisture Sample: Test Specimen

Initial Dry Unit Weight: 111.6 pcf
Initial Water Content: 18.6%
Unconfined Compressive Strength, q_u: **2.079** KSF
Undrained Shear Strength, s_u: **1.040** KSF

Liquid Limit: ND
Plasticity Index: ND
Height to Diameter Ratio: 1.7
Rate of Strain (%/min.): 1
Strain at Failure: 18.0

References / Comments / Deviations:

Sample is not within H/D ratio allowed by specification section 7.1. This sample is 1.7 and allowable range is 2.0-2.5.

Visual ID, as no class testing was needed. Specimen contained large size gravel in center.

Christina Jauregui	Christina Jauregui	T4	6/12/2024
Technical Responsibility	*Signature*	*Position*	*Date*

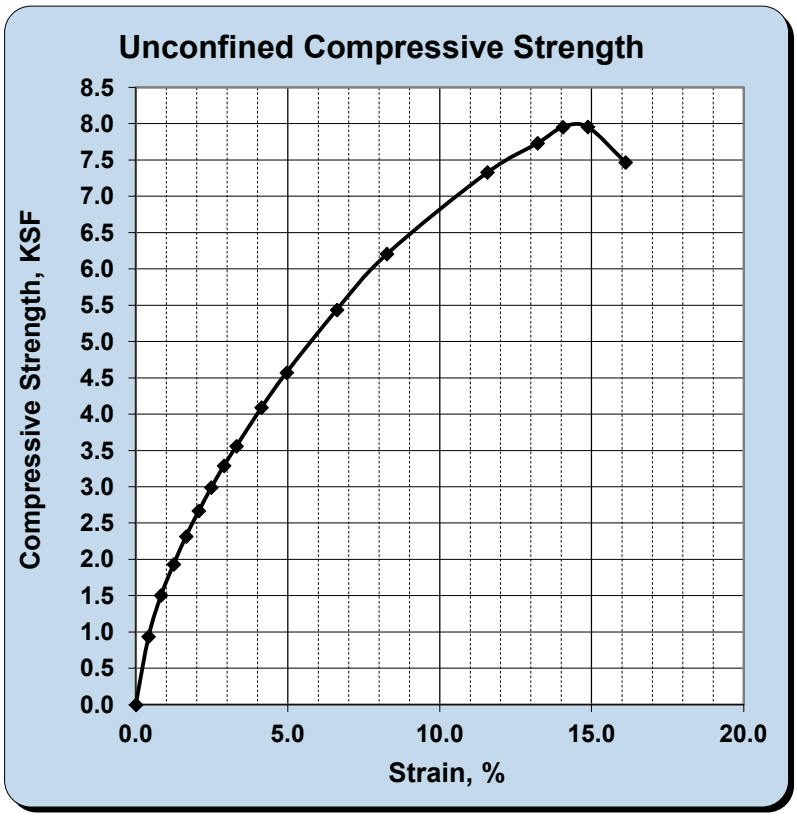
Form No. TR-D2166-01
Revision No. : 1
Revision Date: 08/16/17

UNCONFINED COMPRESSIVE STRENGTH OF COHESIVE SOILS

ASTM D2166

S&ME, Inc. - Columbus: 6190 Enterprise Court, Dublin, Ohio 43016

Project No.:	22-17-0059B	Report Date:	9/18/2023
Project Name:	LAK-90-2.93	Test Date(s):	8/16/2023
Client Name:	WSP		
Client Address:	2 Miranova Place, Suite 450, Columbus OH 43215		
Boring No.:	B-007-0-22 Sample No. S-7 ST II		
		Depth:	9.0'-11.0'
Sample Description:	SILT and CLAY (A-6a), little fine to coarse sand, trace fine gravel.		



Failed Specimen

Type of Sample: Intact
Source of Moisture Sample: Test Specimen

Initial Dry Unit Weight: 119.4 pcf
Initial Water Content: 15.5%
Unconfined Compressive Strength, q_u: **7.956** KSF
Undrained Shear Strength, s_u: **3.978** KSF

Liquid Limit: 34
Plasticity Index: 15
Height to Diameter Ratio: 2.1
Rate of Strain (%/min.): 0.9
Strain at Failure: 14.9

References / Comments / Deviations:

Specimen required minor patchwork.

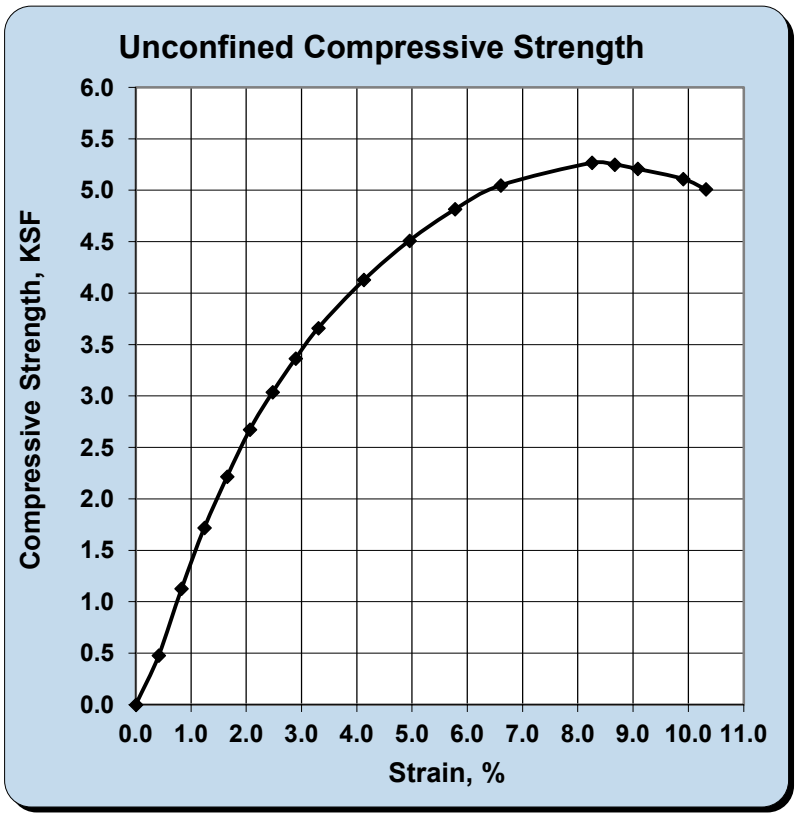
Paula Manning	Paula J Manning	Lab Manager	9/18/2023
Technical Responsibility	*Signature*	*Position*	*Date*

UNCONFINED COMPRESSIVE STRENGTH OF COHESIVE SOILS

ASTM D2166

S&ME, Inc. - Columbus: 6190 Enterprise Court, Dublin, Ohio 43016

Project No.:	22-17-0059B	Report Date:	9/18/2023
Project Name:	LAK-90-2.93	Test Date(s):	8/16/2023
Client Name:	WSP		
Client Address:	2 Miranova Place, Suite 450, Columbus OH 43215		
Boring No.:	B-007-0-22 Sample No. S-13 ST II		
		Depth:	18.5'-20.5'
Sample Description:	SILTY CLAY (A-6b), little fine to coarse sand, trace fine gravel.		



Failed Specimen

Type of Sample: Intact
Source of Moisture Sample: Test Specimen

Initial Dry Unit Weight: 114.2 pcf
Initial Water Content: 17.5%
Unconfined Compressive Strength, q_u: **5.268** KSF
Undrained Shear Strength, s_u: **2.634** KSF

Liquid Limit: 36
Plasticity Index: 17
Height to Diameter Ratio: 2.1
Rate of Strain (%/min.): 1
Strain at Failure: 8.3

References / Comments / Deviations:

Paula Manning	Paula J Manning	Lab Manager	9/18/2023
Technical Responsibility	*Signature*	*Position*	*Date*

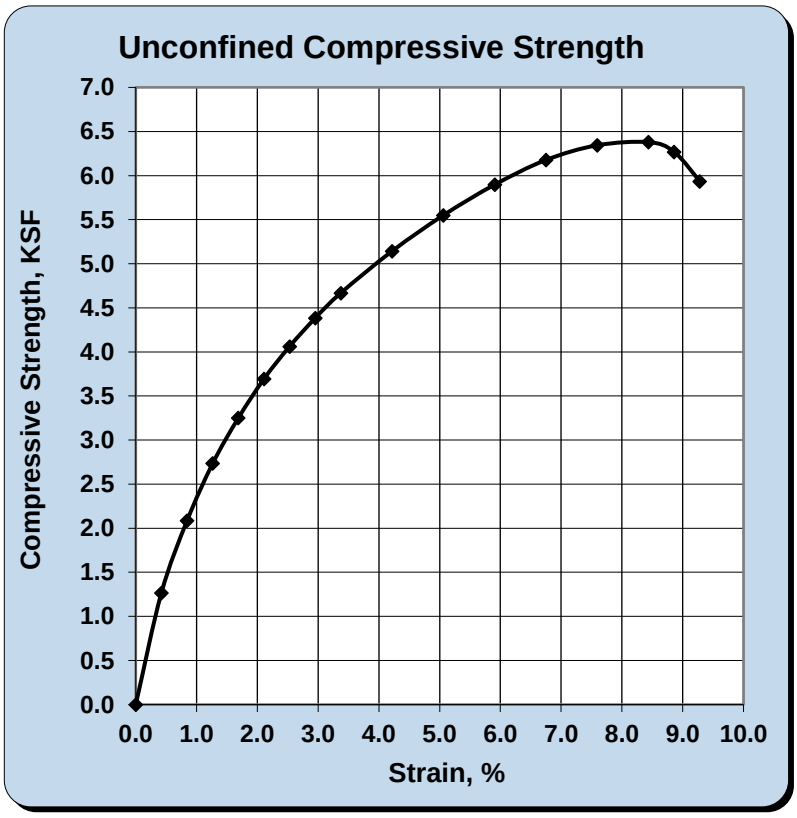
Form No. TR-D2166-01
Revision No. : 1
Revision Date: 08/16/17

UNCONFINED COMPRESSIVE STRENGTH OF COHESIVE SOILS

ASTM D2166

S&ME, Inc. - Columbus: 6190 Enterprise Court, Dublin, Ohio 43016

Project No.:	22170059B	Report Date:	6/10/2024
Project Name:	LAK-90-2.93 Slope Repair	Test Date(s):	5/29/2024
Client Name:	WSP USA Inc.		
Client Address:	2 Miranova Place, Suite 450, Columbus, OH 43215		
Boring No.:	B-007-3-23 Sample No. ST-1		
		Depth (ft):	8.0-10.0
Sample Description:	Visual ID: SILT AND CLAY (A-6a), little to some fine to coarse sand, trace fine gravel.		



Failed Specimen

Type of Sample: Intact
Source of Moisture Sample: Test Specimen

Initial Dry Unit Weight: 114.4 pcf
Initial Water Content: 17.1%
Unconfined Compressive Strength, q_u: **6.379** KSF
Undrained Shear Strength, s_u: **3.189** KSF

Liquid Limit: ND
Plasticity Index: ND
Height to Diameter Ratio: 2.1
Rate of Strain (%/min.): 1
Strain at Failure: 8.4

References / Comments / Deviations:

Visual ID, as no class testing was needed.

Christina Jauregui	Christina Jauregui	T4	6/12/2024
Technical Responsibility	*Signature*	*Position*	*Date*

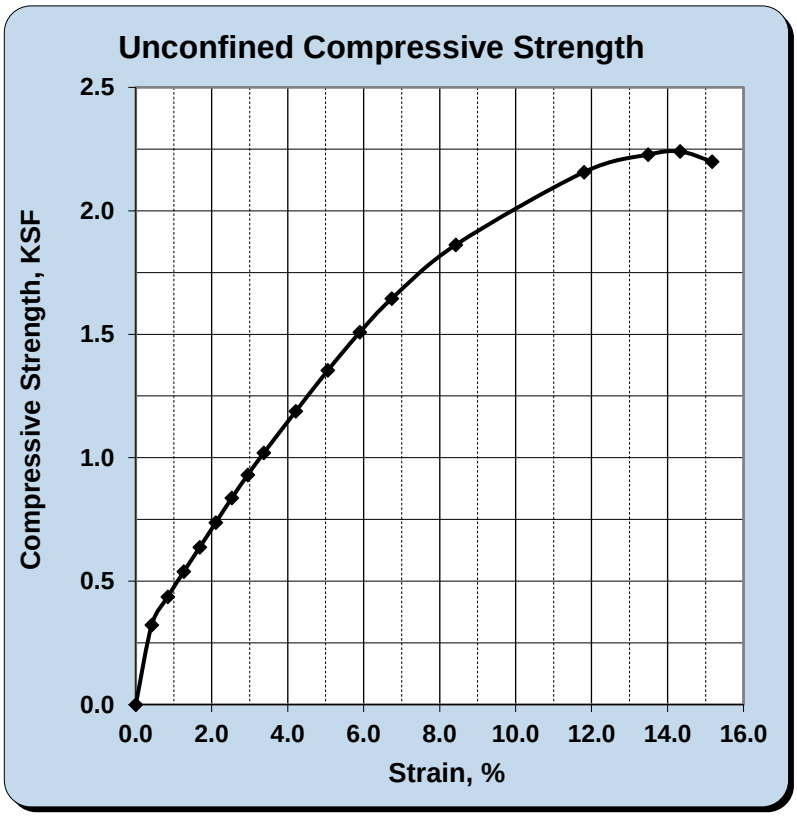
Form No. TR-D2166-01
Revision No. : 1
Revision Date: 08/16/17

UNCONFINED COMPRESSIVE STRENGTH OF COHESIVE SOILS

ASTM D2166

S&ME, Inc. - Columbus: 6190 Enterprise Court, Dublin, Ohio 43016

Project No.:	22170059B	Report Date:	6/7/2024
Project Name:	LAK-90-2.93 Slope Repair	Test Date(s):	5/29/2024
Client Name:	WSP USA Inc.		
Client Address:	2 Miranova Place, Suite 450, Columbus, OH 43215		
Boring No.:	B-007-4-23 Sample No. ST-16		
		Depth (ft):	38.0-40.0
Sample Description:	SILT and CLAY (A-6a), some fine to coarse sand, trace fine gravel.		



Failed Specimen

Type of Sample: Intact
Source of Moisture Sample: Test Specimen

Initial Dry Unit Weight: 106.9 pcf
Initial Water Content: 21.7%
Unconfined Compressive Strength, q_u: **2.241** KSF
Undrained Shear Strength, s_u: **1.120** KSF

Liquid Limit: 31
Plasticity Index: 12
Height to Diameter Ratio: 2.1
Rate of Strain (%/min.): 1
Strain at Failure: 14.3

References / Comments / Deviations:

Christina Jauregui	Christina Jauregui	T4	6/12/2024
Technical Responsibility	*Signature*	*Position*	*Date*

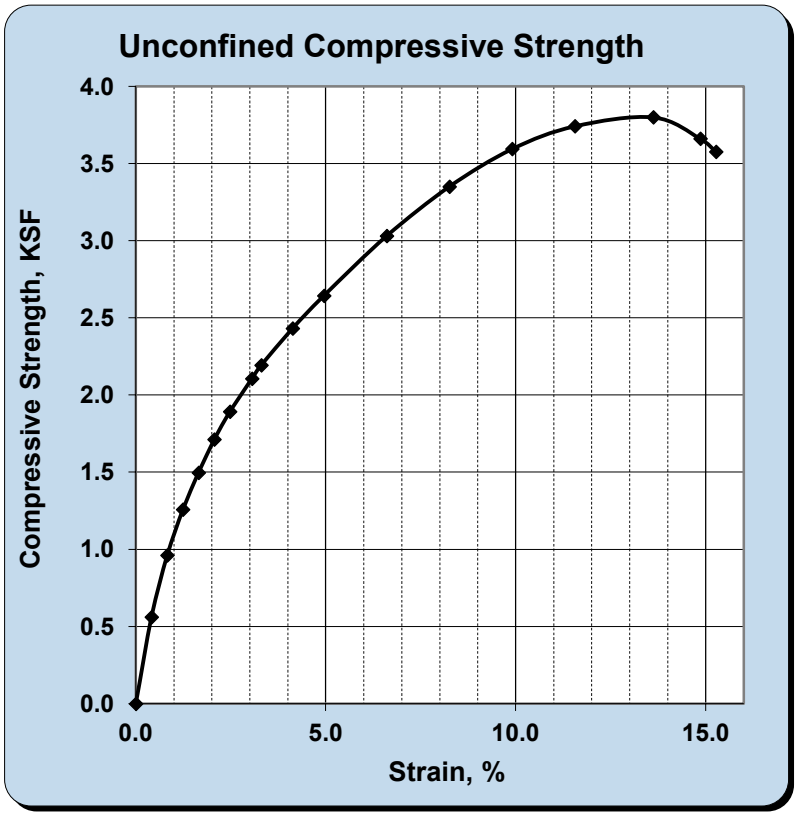
Form No. TR-D2166-01
Revision No. : 1
Revision Date: 08/16/17

UNCONFINED COMPRESSIVE STRENGTH OF COHESIVE SOILS

ASTM D2166

S&ME, Inc. - Columbus: 6190 Enterprise Court, Dublin, Ohio 43016

Project No.:	22-17-0059B	Report Date:	9/18/2023
Project Name:	LAK-90-2.93	Test Date(s):	8/16/2023
Client Name:	WSP		
Client Address:	2 Miranova Place, Suite 450, Columbus OH 43215		
Boring No.:	B-008-1-22 Sample No. S-12 ST II		
		Depth:	16.5'-18.7'
Sample Description:	SILT and CLAY (A-6a), little fine to coarse sand, trace fine to coarse gravel.		



Failed Specimen

Type of Sample: Intact
Source of Moisture Sample: Test Specimen

Liquid Limit: 33
Plasticity Index: 14
Height to Diameter Ratio: 2.1
Rate of Strain (%/min.): 1
Strain at Failure: 13.6

Initial Dry Unit Weight: 116.2 pcf
Initial Water Content: 16.6%
Unconfined Compressive Strength, q_u: **3.800** KSF
Undrained Shear Strength, s_u: **1.900** KSF

References / Comments / Deviations:

Specimen required patchwork on sides.

Paula Manning	Paula J Manning	Lab Manager	9/18/2023
Technical Responsibility	*Signature*	*Position*	*Date*

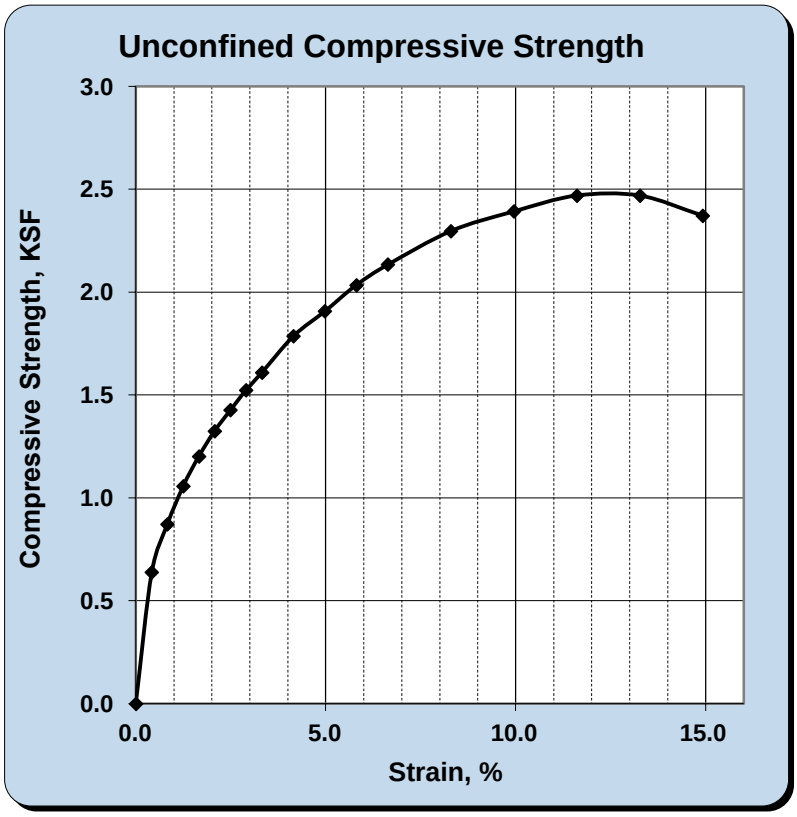
Form No. TR-D2166-01
Revision No. : 1
Revision Date: 08/16/17

UNCONFINED COMPRESSIVE STRENGTH OF COHESIVE SOILS

ASTM D2166

S&ME, Inc. - Columbus: 6190 Enterprise Court, Dublin, Ohio 43016

Project No.:	22-17-0059B	Report Date:	9/18/2023
Project Name:	LAK-90-2.93	Test Date(s):	8/16/2023
Client Name:	WSP		
Client Address:	2 Miranova Place, Suite 450, Columbus OH 43215		
Boring No.:	B-008-1-22 Sample No. S-33 ST II		
		Depth:	3.0' to 4.7'
Sample Description:	SILT and CLAY (A-6a), little fine to coarse sand, trace fine gravel.		



Failed Specimen

Type of Sample: Intact
Source of Moisture Sample: Test Specimen

Initial Dry Unit Weight: 115.7 pcf
Initial Water Content: 17.0%
Unconfined Compressive Strength, q_u: **2.470** KSF
Undrained Shear Strength, s_u: **1.235** KSF

Liquid Limit: 33
Plasticity Index: 15
Height to Diameter Ratio: 2.1
Rate of Strain (%/min.): 1
Strain at Failure: 12.3

References / Comments / Deviations:

Specimen required minor patchwork.

Paula J Manning

Paula Manning		Lab Manager	9/18/2023
Technical Responsibility	*Signature*	*Position*	*Date*

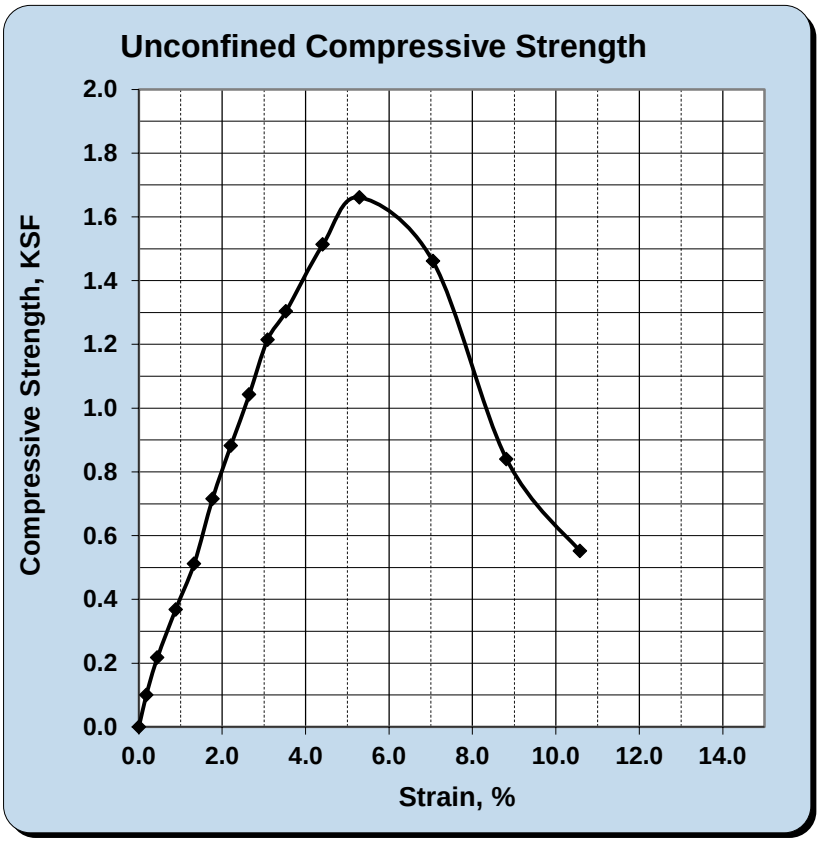
Form No. TR-D2166-01
Revision No. : 1
Revision Date: 08/16/17

UNCONFINED COMPRESSIVE STRENGTH OF COHESIVE SOILS

ASTM D2166

S&ME, Inc. Cincinnati: 862 East Crescentville Road, West Chester, OH 45246

Project No.:	22170059B	Report Date:	6/13/2024
Project Name:	LAK-90-2.93 Slope Repair	Test Date(s):	5/31/2024
Client Name:			
Client Address:			
Location:	B-009-1-23	Sample No. S-6	Sample Date:
			Depth: 13.5-15.2
Sample Description:	SANDY SILT (A-4a), "and" fine to coarse gravel, little clay		



Failed Specimen

Type of Sample: Intact
Source of Moisture Sample: Test Specimen

Initial Dry Unit Weight: 119.3 pcf
Initial Water Content: 14.0%
Unconfined Compressive Strength, q_u: **1.662** KSF
Undrained Shear Strength, s_u: **0.831** KSF

Liquid Limit: 23
Plasticity Index: 9
Height to Diameter Ratio: 2.0
Rate of Strain (%/min.): 0.0096
Strain at Failure: 6.9

References / Comments / Deviations:

Sample was dry.

K. Cannady		QAS	6/13/2024
Technical Responsibility	*Signature*	*Position*	*Date*

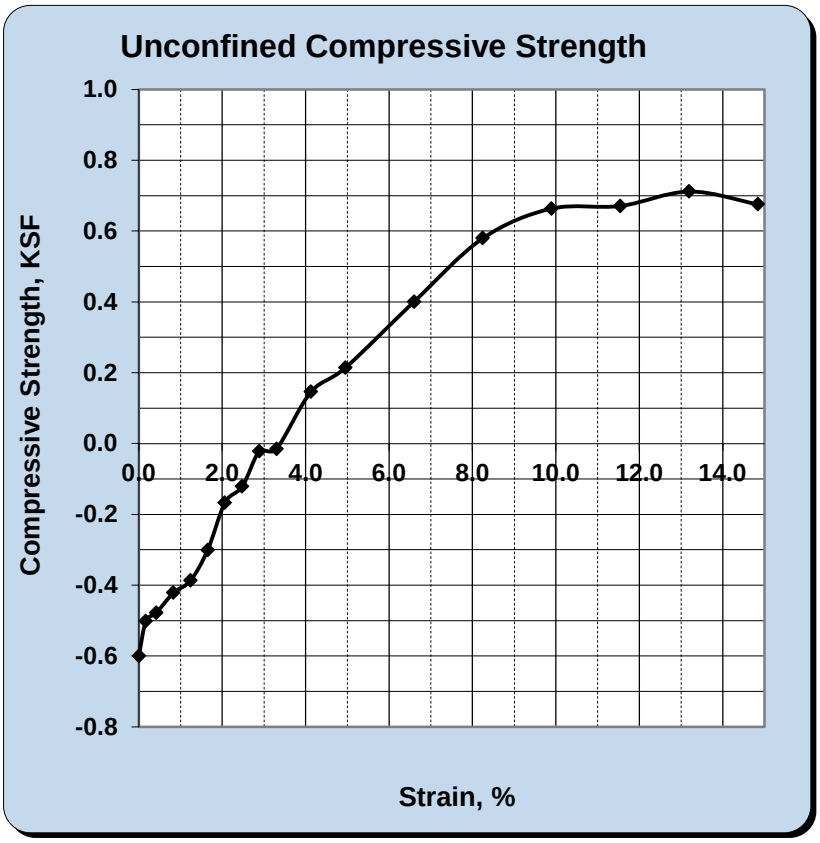
Form No. TR-D2166-01
Revision No. : 1
Revision Date: 08/16/17

UNCONFINED COMPRESSIVE STRENGTH OF COHESIVE SOILS

ASTM D2166

S&ME, Inc. Cincinnati: 862 East Crescentville Road, West Chester, OH 45246

Project No.:	22170059B	Report Date:	6/13/2024
Project Name:	LAK-90-2.93 Slope Repair	Test Date(s):	5/31/2024
Client Name:			
Client Address:			
Location:	B-009-1-23	Sample No. S-17	Sample Date:
			Depth: 41.0-42.9
Sample Description:	SILTY CLAY (A-6b), little fine to coarse gravel, little fine to coarse sand		



Failed Specimen

Type of Sample: Intact
Source of Moisture Sample: Test Specimen

Initial Dry Unit Weight: 102.4 pcf
Initial Water Content: 22.1%
Unconfined Compressive Strength, q_u: **0.712** KSF
Undrained Shear Strength, s_u: **0.356** KSF

Liquid Limit: 35
Plasticity Index: 16
Height to Diameter Ratio: 2.1
Rate of Strain (%/min.): 0.009
Strain at Failure: 6.9

References / Comments / Deviations:

K. Cannady		QAS	6/13/2024
Technical Responsibility	*Signature*	*Position*	*Date*

Form No. TR-D7012C-01
Revision No. 1
Revision Date: 07/14/17

UNIAXIAL COMPRESSIVE STRENGTH OF ROCK

ASTM D 7012 Method C

Quality Assurance

S&ME, Inc. - Columbus: 6190 Enterprise Court, Dublin, Ohio 43016

Project No.:	22170059B	Report Date:	03/20/23
Project Name:	LAK-90-2.93 Slope Repair	Test Date(s):	03/17/23
Client Name:	WSP USA Inc.		
Client Address:	2 Miranova Place, Suite 450, Columbus OH 43215		
Boring ID:	B-001-1-22, NQ-11	Depth/Elev., ft:	17.9' to 18.3'
Sample Description:	SHALE, gray		

Angle of load relative to lithology: Approximately perpendicular to bedding plane

Test Results

Moisture Content ***6.9*** **%** ***Dry Unit Weight*** ***141.3*** **pcf**

Compressive Strength ***116*** **psi**

Before Test

After Test

Strain rate: 0.9 %/min.

Notes / Deviations / References: **Specimen end preparation not done in accordance with ASTM D4543.**

Specimen capped using high strength gypsum in accordance with ASTM C617.

Test results for specimens not meeting this requirement may differ from test results obtained from specimens meeting this requirement.

Paula Manning	Paula J Manning	Lab Manager	3/20/2023
Technical Responsibility	*Signature*	*Position*	*Date*

Form No. TR-D7012C-01
Revision No. 1
Revision Date: 07/14/17

UNIAXIAL COMPRESSIVE STRENGTH OF ROCK

ASTM D 7012 Method C

Quality Assurance

S&ME, Inc. - Columbus: 6190 Enterprise Court, Dublin, Ohio 43016

Project No.:	22170059B	Report Date:	03/09/23
Project Name:	LAK-90-2.93 Slope Repair	Test Date(s):	03/07/23
Client Name:	WSP USA Inc.		
Client Address:	2 Miranova Place, Suite 450, Columbus OH 43215		
Boring ID:	B-001-1-22, NQ-12	Depth/Elev., ft:	23.3' to 23.7'
Sample Description:	SHALE, gray		

Angle of load relative to lithology: Approximately perpendicular to bedding plane

Test Results

Moisture Content ***5.5*** **%** ***Dry Unit Weight*** ***147.6*** **pcf**

Compressive Strength ***441*** **psi**

Before Test

After Test

Strain rate: 0.9 %/min.

Notes / Deviations / References: **Specimen contained horizontal fractures. Specimen end preparation not done in accordance with ASTM D4543. Specimen capped using high strength gypsum in accordance with ASTM C617. Test results for specimens not meeting this requirement may differ from test results obtained from specimens meeting this requirement.**

Paula Manning	Paula J Manning	Lab Manager	3/9/2023
Technical Responsibility	*Signature*	*Position*	*Date*

Form No. TR-D7012C-01
Revision No. 1
Revision Date: 07/14/17

UNIAXIAL COMPRESSIVE STRENGTH OF ROCK

ASTM D 7012 Method C

Quality Assurance

S&ME, Inc. - Columbus: 6190 Enterprise Court, Dublin, Ohio 43016

Project No.:	22170059B	Report Date:	03/09/23
Project Name:	LAK-90-2.93 Slope Repair	Test Date(s):	03/07/23
Client Name:	WSP USA Inc.		
Client Address:	2 Miranova Place, Suite 450, Columbus OH 43215		
Boring ID:	B-002-0-22, NQ-41	Depth/Elev., ft:	73.6' to 73.9'
Sample Description:	SHALE, gray		

Angle of load relative to lithology: Approximately perpendicular to bedding plane

Test Results

Moisture Content ***3.7*** **%** ***Dry Unit Weight*** ***152.6*** **pcf**

Compressive Strength ***1,547*** **psi**

Before Test

After Test

Strain rate: 0.9 %/min.

Notes / Deviations / References: **Specimen end preparation not done in accordance with ASTM D4543.**

Specimen capped using high strength gypsum in accordance with ASTM C617.

Test results for specimens not meeting this requirement may differ from test results obtained from specimens meeting this requirement.

Paula Manning	Paula J Manning	Lab Manager	3/9/2023
Technical Responsibility	*Signature*	*Position*	*Date*

Form No. TR-D7012C-01
Revision No. 1
Revision Date: 07/14/17

UNIAXIAL COMPRESSIVE STRENGTH OF ROCK

ASTM D 7012 Method C

Quality Assurance

S&ME, Inc. - Columbus: 6190 Enterprise Court, Dublin, Ohio 43016

Project No.:	22-17-0059B	Report Date:	06/12/24
Project Name:	LAK-90-2.93 Slope Repair	Test Date(s):	06/07/24
Client Name:	WSP USA, Inc.		
Client Address:	2 Miranova Place, Suite 450, Columbus, Ohio 43215	Received Date:	05/17/24
Boring ID:	B-005-1-23, NQ-5	Depth/Elev., ft:	46.4 - 46.8
Sample Description:	SHALE, gray		

Angle of load relative to lithology: Approximately perpendicular to bedding plane

Test Results

Moisture Content ***3.6*** **%** ***Dry Unit Weight*** ***154.3*** **pcf**

Compressive Strength ***1,327*** **psi**

Before Test

After Test

Strain rate: 0.9 %/min.

Notes / Deviations / References: **Specimen end preparation not done in accordance with ASTM D4543.**

Specimen capped using high strength gypsum in accordance with ASTM C617.

Test results for specimens not meeting this requirement may differ from test results obtained from specimens meeting this requirement.

Paula J. Manning	Paula J Manning	Lab Manager	6/12/2024
Technical Responsibility	*Signature*	*Position*	*Date*

PLATE 28

Form No. TR-D7012C-01
Revision No. 1
Revision Date: 07/14/17

UNIAXIAL COMPRESSIVE STRENGTH OF ROCK

ASTM D 7012 Method C

Quality Assurance

S&ME, Inc. - Columbus: 6190 Enterprise Court, Dublin, Ohio 43016

Project No.:	22-17-0059B	Report Date:	06/13/24
Project Name:	LAK-90-2.93 Slope Repair	Test Date(s):	06/07/24
Client Name:	WSP USA, Inc.		
Client Address:	2 Miranova Place, Suite 450, Columbus, Ohio 43215	Received Date:	05/17/24
Boring ID:	B-005-1-23, NQ-8	Depth/Elev., ft:	60.8 - 61.2
Sample Description:	SHALE, gray		

Angle of load relative to lithology: Approximately perpendicular to bedding plane

Test Results

Moisture Content ***3.4*** **%** ***Dry Unit Weight*** ***154.9*** **pcf**

Compressive Strength ***1,554*** **psi**

Before Test

After Test

Strain rate: 0.9 %/min.

Notes / Deviations / References: **Specimen end preparation not done in accordance with ASTM D4543.**

Specimen capped using high strength gypsum in accordance with ASTM C617.

Test results for specimens not meeting this requirement may differ from test results obtained from specimens meeting this requirement. Specimen contains horizontal fractures.

Paula J. Manning	Paula J Manning	Lab Manager	6/12/2024
Technical Responsibility	*Signature*	*Position*	*Date*

Form No. TR-D7012C-01
Revision No. 1
Revision Date: 07/14/17

UNIAXIAL COMPRESSIVE STRENGTH OF ROCK

ASTM D 7012 Method C

Quality Assurance

S&ME, Inc. - Columbus: 6190 Enterprise Court, Dublin, Ohio 43016

Project No.:	22-17-0059B	Report Date:	06/13/24
Project Name:	LAK-90-2.93 Slope Repair	Test Date(s):	06/07/24
Client Name:	WSP USA, Inc.		
Client Address:	2 Miranova Place, Suite 450, Columbus, Ohio 43215	Received Date:	05/17/24
Boring ID:	B-007-3-23, NQ-4	Depth/Elev., ft:	46.9 - 47.3
Sample Description:	SHALE, gray		

Angle of load relative to lithology: Approximately perpendicular to bedding plane

Test Results

Moisture Content ***6.2*** **%** ***Dry Unit Weight*** ***138.0*** **pcf**

Compressive Strength ***167*** **psi**

Before Test

After Test

Strain rate: 0.9 %/min.

Notes / Deviations / References: **Specimen end preparation not done in accordance with ASTM D4543.**

Specimen capped using high strength gypsum in accordance with ASTM C617.

Test results for specimens not meeting this requirement may differ from test results obtained from specimens meeting this requirement. Specimen contains horizontal fractures.

Paula J. Manning	Paula J Manning	Lab Manager	6/12/2024
Technical Responsibility	*Signature*	*Position*	*Date*

Form No. TR-D7012C-01
Revision No. 1
Revision Date: 07/14/17

UNIAXIAL COMPRESSIVE STRENGTH OF ROCK

ASTM D 7012 Method C

Quality Assurance

S&ME, Inc. - Columbus: 6190 Enterprise Court, Dublin, Ohio 43016

Project No.:	22-17-0059B	Report Date:	06/13/24
Project Name:	LAK-90-2.93 Slope Repair	Test Date(s):	06/07/24
Client Name:	WSP USA, Inc.		
Client Address:	2 Miranova Place, Suite 450, Columbus, Ohio 43215	Received Date:	05/17/24
Boring ID:	B-007-3-23, NQ-6	Depth/Elev., ft:	59.6 - 60.0
Sample Description:	SHALE, gray		

Angle of load relative to lithology: Approximately perpendicular to bedding plane

Test Results

Moisture Content ***6.7*** **%** ***Dry Unit Weight*** ***134.6*** **pcf**

Compressive Strength ***78*** **psi**

Before Test

After Test

Strain rate: 0.9 %/min.

Notes / Deviations / References: **Specimen end preparation not done in accordance with ASTM D4543.**

Specimen capped using high strength gypsum in accordance with ASTM C617.

Test results for specimens not meeting this requirement may differ from test results obtained from specimens meeting this requirement.

Paula J. Manning	Paula J Manning	Lab Manager	6/12/2024
Technical Responsibility	*Signature*	*Position*	*Date*

Form No. TR-D7012C-01
Revision No. 1
Revision Date: 07/14/17

UNIAXIAL COMPRESSIVE STRENGTH OF ROCK

ASTM D 7012 Method C

Quality Assurance

S&ME, Inc. - Columbus: 6190 Enterprise Court, Dublin, Ohio 43016

Project No.:	22-17-0059B	Report Date:	06/14/24
Project Name:	LAK-90-2.93 Slope Repair	Test Date(s):	06/07/24
Client Name:	WSP USA, Inc.		
Client Address:	2 Miranova Place, Suite 450, Columbus, Ohio 43215	Received Date:	05/17/24
Boring ID:	B-007-4-23, NQ-22	Depth/Elev., ft:	54.6 - 56.0
Sample Description:	SHALE, gray		

Angle of load relative to lithology: Approximately perpendicular to bedding plane

Test Results

Moisture Content ***7.8*** **%** ***Dry Unit Weight*** ***135.1*** **pcf**

Compressive Strength ***64*** **psi**

Before Test

After Test

Strain rate: 0.9 %/min.

Notes / Deviations / References: **Specimen end preparation not done in accordance with ASTM D4543.**

Specimen capped using high strength gypsum in accordance with ASTM C617.

Test results for specimens not meeting this requirement may differ from test results obtained from specimens meeting this requirement.

Paula J. Manning	Paula J Manning	Lab Manager	6/14/2024
Technical Responsibility	*Signature*	*Position*	*Date*

PLATE 32

Form No. TR-D7012C-01
Revision No. 1
Revision Date: 07/14/17

UNIAXIAL COMPRESSIVE STRENGTH OF ROCK

ASTM D 7012 Method C

Quality Assurance

S&ME, Inc. - Columbus: 6190 Enterprise Court, Dublin, Ohio 43016

Project No.:	22-17-0059B	Report Date:	06/14/24
Project Name:	LAK-90-2.93 Slope Repair	Test Date(s):	06/07/24
Client Name:	WSP USA, Inc.		
Client Address:	2 Miranova Place, Suite 450, Columbus, Ohio 43215	Received Date:	05/17/24
Boring ID:	B-007-4-23, NQ-23	Depth/Elev., ft:	62.4 - 62.8
Sample Description:	SHALE, gray		

Angle of load relative to lithology: Approximately perpendicular to bedding plane

Test Results

Moisture Content ***3.7*** **%** ***Dry Unit Weight*** ***152.3*** **pcf**

Compressive Strength ***950*** **psi**

Before Test

After Test

Strain rate: 0.9 %/min.

Notes / Deviations / References: **Specimen end preparation not done in accordance with ASTM D4543.**

Specimen capped using high strength gypsum in accordance with ASTM C617.

Test results for specimens not meeting this requirement may differ from test results obtained from specimens meeting this requirement.

Paula J. Manning	Paula J Manning	Lab Manager	6/14/2024
Technical Responsibility	*Signature*	*Position*	*Date*

PLATE 33

Form No. TR-D7012C-01
Revision No. 1
Revision Date: 07/14/17

UNIAXIAL COMPRESSIVE STRENGTH OF ROCK

ASTM D 7012 Method C

Quality Assurance

S&ME, Inc. - Columbus: 6190 Enterprise Court, Dublin, Ohio 43016

Project No.:	22-17-0059B	Report Date:	06/12/24
Project Name:	LAK-90-2.93 Slope Repair	Test Date(s):	06/11/24
Client Name:	WSP USA, Inc.		
Client Address:	2 Miranova Place, Suite 450, Columbus, Ohio 43215	Received Date:	05/17/24
Boring ID:	B-008-4-23, NQ-3	Depth/Elev., ft:	60.5 - 60.9
Sample Description:	SHALE, gray		

Angle of load relative to lithology: Approximately perpendicular to bedding plane

Test Results

Moisture Content ***3.0*** **%** ***Dry Unit Weight*** ***154.6*** **pcf**

Compressive Strength ***1,763*** **psi**

Before Test

After Test

Strain rate: 0.9 %/min.

Notes / Deviations / References: **Specimen end preparation not done in accordance with ASTM D4543.**

Specimen capped using high strength gypsum in accordance with ASTM C617.

Test results for specimens not meeting this requirement may differ from test results obtained from specimens meeting this requirement.

Paula J. Manning	Paula J Manning	Lab Manager	6/12/2024
Technical Responsibility	*Signature*	*Position*	*Date*

Form No. TR-D7012C-01
Revision No. 1
Revision Date: 07/14/17

UNIAXIAL COMPRESSIVE STRENGTH OF ROCK

ASTM D 7012 Method C

Quality Assurance

S&ME, Inc. - Columbus: 6190 Enterprise Court, Dublin, Ohio 43016

Project No.:	22-17-0059B	Report Date:	06/12/24
Project Name:	LAK-90-2.93 Slope Repair	Test Date(s):	06/11/24
Client Name:	WSP USA, Inc.		
Client Address:	2 Miranova Place, Suite 450, Columbus, Ohio 43215	Received Date:	05/17/24
Boring ID:	B-008-4-23, NQ-5	Depth/Elev., ft:	69.0 - 69.4
Sample Description:	SHALE, gray		

Angle of load relative to lithology: Approximately perpendicular to bedding plane

Test Results

Moisture Content ***3.6*** **%** ***Dry Unit Weight*** ***154.8*** **pcf**

Compressive Strength ***1,133*** **psi**

Before Test

After Test

Strain rate: 0.9 %/min.

Notes / Deviations / References: **Specimen end preparation not done in accordance with ASTM D4543.**

Specimen capped using high strength gypsum in accordance with ASTM C617.

Test results for specimens not meeting this requirement may differ from test results obtained from specimens meeting this requirement.

Paula J. Manning	Paula J Manning	Lab Manager	6/12/2024
Technical Responsibility	*Signature*	*Position*	*Date*

Form No. TR-D7012C-01
Revision No. 1
Revision Date: 07/14/17

UNIAXIAL COMPRESSIVE STRENGTH OF ROCK

ASTM D 7012 Method C

Quality Assurance

S&ME, Inc. - Columbus: 6190 Enterprise Court, Dublin, Ohio 43016

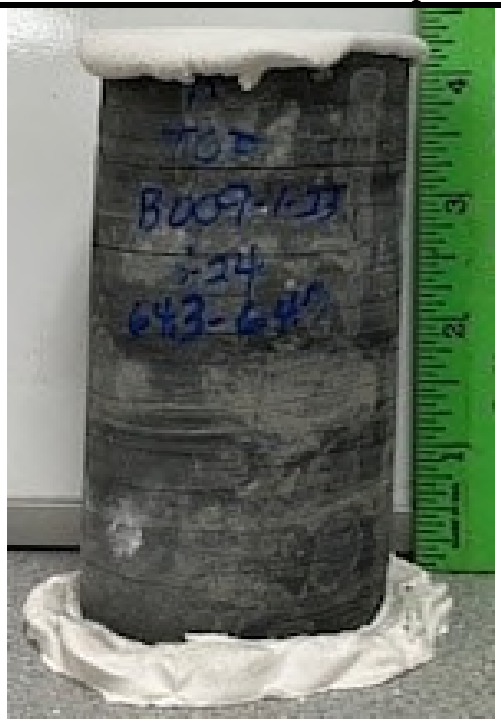
Project No.:	22-17-0059B	Report Date:	06/12/24
Project Name:	LAK-90-2.93 Slope Repair	Test Date(s):	06/11/24
Client Name:	WSP USA, Inc.		
Client Address:	2 Miranova Place, Suite 450, Columbus, Ohio 43215	Received Date:	05/17/24
Boring ID:	B-009-1-23, NQ-24	Depth/Elev., ft:	64.3 - 64.7
Sample Description:	SHALE, gray		

Angle of load relative to lithology: Approximately perpendicular to bedding plane

Test Results

Moisture Content ***3.6*** **%** ***Dry Unit Weight*** ***154.2*** **pcf**

Compressive Strength ***924*** **psi**



Before Test

After Test

Strain rate: 0.9 %/min.

Notes / Deviations / References: **Specimen end preparation not done in accordance with ASTM D4543.**

Specimen capped using high strength gypsum in accordance with ASTM C617.

Test results for specimens not meeting this requirement may differ from test results obtained from specimens meeting this requirement.

Paula J. Manning	Paula J Manning	Lab Manager	6/12/2024
Technical Responsibility	*Signature*	*Position*	*Date*

PLATE 36

Form No. TR-D7012C-01
Revision No. 1
Revision Date: 07/14/17

UNIAXIAL COMPRESSIVE STRENGTH OF ROCK

ASTM D 7012 Method C

Quality Assurance

S&ME, Inc. - Columbus: 6190 Enterprise Court, Dublin, Ohio 43016

Project No.:	22-17-0059B	Report Date:	06/12/24
Project Name:	LAK-90-2.93 Slope Repair	Test Date(s):	06/11/24
Client Name:	WSP USA, Inc.		
Client Address:	2 Miranova Place, Suite 450, Columbus, Ohio 43215	Received Date:	05/17/24
Boring ID:	B-009-1-23, NQ-25	Depth/Elev., ft:	70.1 - 70.5
Sample Description:	SHALE, gray		

Angle of load relative to lithology: Approximately perpendicular to bedding plane

Test Results

Moisture Content ***3.0*** **%** ***Dry Unit Weight*** ***156.8*** **pcf**

Compressive Strength ***1,448*** **psi**

Before Test

After Test

Strain rate: 0.9 %/min.

Notes / Deviations / References: **Specimen end preparation not done in accordance with ASTM D4543.**

Specimen capped using high strength gypsum in accordance with ASTM C617.

Test results for specimens not meeting this requirement may differ from test results obtained from specimens meeting this requirement.

Paula J. Manning	Paula J Manning	Lab Manager	6/12/2024
Technical Responsibility	*Signature*	*Position*	*Date*

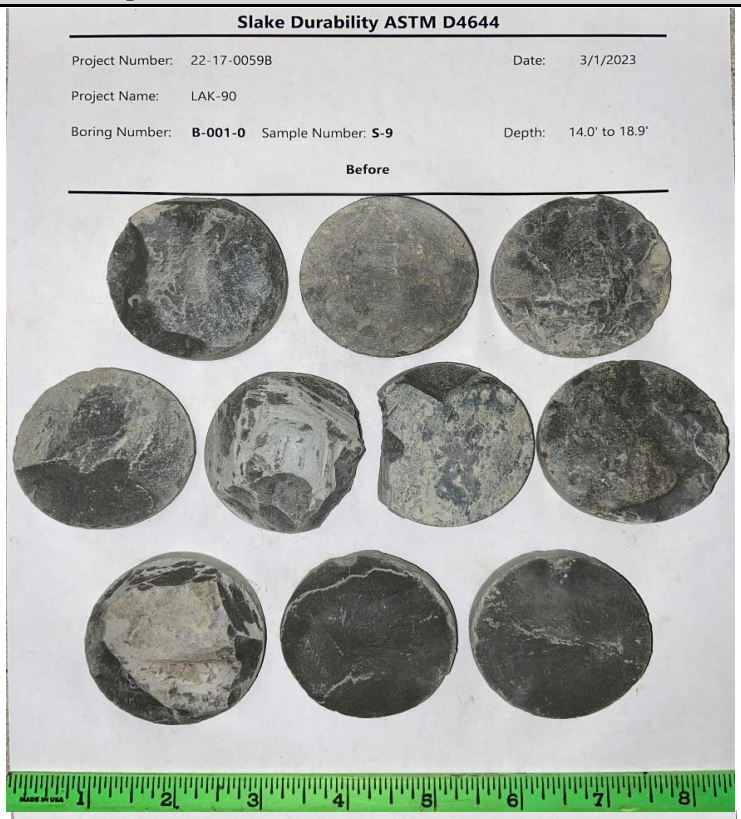
PLATE 37

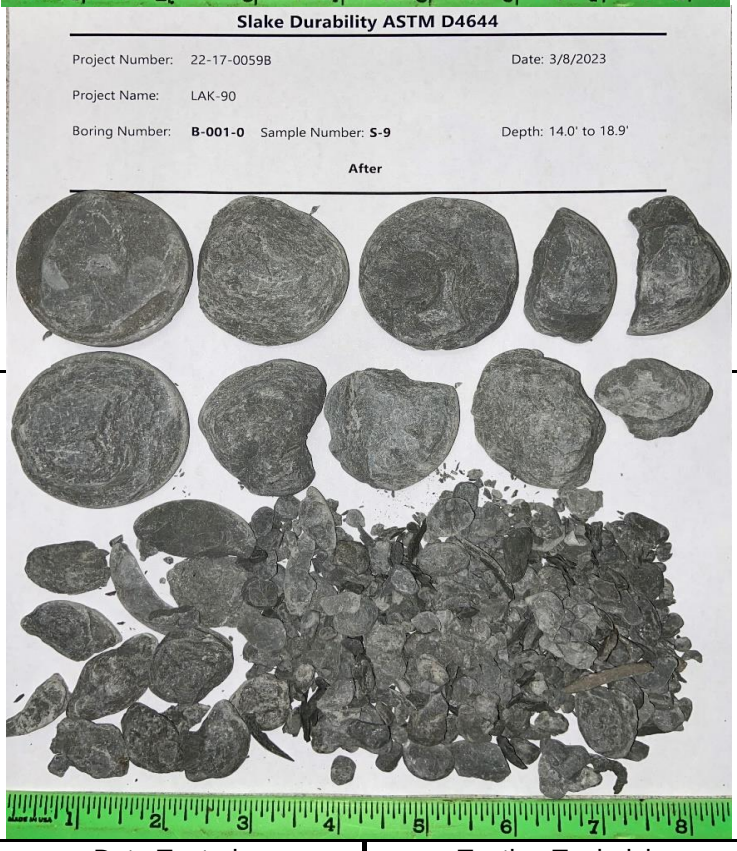
Slake Durability Index Test Report

ASTM D 4644

S&ME, Inc. - Columbus 6190 Enterprise Court, Dublin, Ohio 43016

Project Information
Project Name
LAK-90-2.93 Slope Repair
Project Number
22170059B
Specimen Information
Boring ID
B-001-0-22 NQ-9
Sample Depth, feet
14.0' to 18.9'
Sample Description
SHALE
Water Temperature, ºC
19.6
Test Results
Natural Water Content, %
3.2
Slake Durability Index, 1st cycle, %
88.6
Slake Durability Index, 2nd cycle, %
71.5





Description of Fragments	Date Tested	Testing Technician
Type II	3/6/2023	CJ

Slake Durability Index Test Report

ASTM D 4644

S&ME, Inc. - Columbus 6190 Enterprise Court, Dublin, Ohio 43016

Project Information
Project Name
LAK-90-2.93 Slope Repair
Project Number
22170059B
Specimen Information
Boring ID
B-001-1-22 NQ-12
Sample Depth, feet
19.5' to 25.1'
Sample Description
SHALE
Water Temperature, ºC
19.6
Test Results
Natural Water Content, %
3.1
Slake Durability Index, 1st cycle, %
79.4
Slake Durability Index, 2nd cycle, %
62.1

Slake Durability ASTM D4644

Project Number: 22-17-0059B Date: 3/1/2023

Project Name: LAK-90

Boring Number: **B-001-1** Sample Number: **S-12** Depth: 19.5' to 25.1'

Before

Slake Durability ASTM D4644

Project Number: 22-17-0059B Date: 3/8/2023

Project Name: LAK-90

Boring Number: **B-001-1** Sample Number: **S-12** Depth: 19.5' to 25.1'

After

Description of Fragments	Date Tested	Testing Technician
Type II	3/6/2023	CJ

Form No: TR-D4644-1
Revision No. 1
Revision Date: 5/24/2024

Slake Durability of Shales and Weak Rocks

ASTM D4644

S&ME, Inc. - Columbus: 6190 Enterprise Court, Dublin, Ohio 43016

Project Number:	22170059B	Report Date:	6/14/24
Project Name:	LAK-90-2.93 Slope Repair	Test Date(s):	6/10-13/2024
Client Name:	WSP		
Client Address:	2 Miranova Place, Suite 450, Columbus, OH 43215		
Boring:	B-005-1-23	Sample #:	NQ-5
Sample Date:	5/13/2024		
Depth (ft):	44.2-49.2		
Sample Description:	SHALE, gray		

Equipment Used:

Slake Durability Machine:	S&ME ID#:	28074	Drum (g):	823.59	Calibration Date:	5/16/24
Timer:	S&ME ID#:	29622	Readability:	1 second	Calibration Date:	1/8/24
Balance (1g):	S&ME ID#:	27984	Readability:	0.01 g	Calibration Date:	10/19/23

Mass of Individual Rock Fragments Before Testing without Drum included (grams)

Fragment No. 1:	46.97	Fragment No. 2:	40.67	Fragment No. 3:	57.27
Fragment No. 4:	59.45	Fragment No. 5:	47.40	Fragment No. 6:	56.79
Fragment No. 7:	48.50	Fragment No. 8:	59.89	Fragment No. 9:	44.79
Fragment No. 10:	43.10			Total Masses:	504.83 (Tolerance: 450-550)

Initial Moisture Content of Rock Fragments:

Total Masses of Fragments Before Testing and Drum (g):	1328.42
Total Masses of Fragments After Drying and Drum (g):	1313.42
Water Content of Rock Fragments (g):	15.00
Moisture Content of Rock Fragments:	**3.0%**

Water Temperatures

Water Temperature at the beginning of the cycle:	20.8	°c
Water Temperature at the end of the cycle:	21.7	°c
Average Water Temperature:	**21.3**	°c

Moisture Content of Rock Fragments By Cycle

	Cycle 1	Cycle 2
Total Masses of Fragments After Drying and Drum (g):	1254.30	1190.06

Slake Durability Indexes

First Cycle Index:	87.9%
Second Cycle Index:	**74.8%**

Record comments, notes, and deviations from the test procedure:

ASTM D4644: Slake Durability of Shales and Other Similar Weak Rocks.

Tested By:	Paula J. Manning	Date:	6/14/2024
	Signature		
Reviewed by:	Christina Jauregui	Date:	6/14/2024
	Signature		

Form No: TR-D4644-2
Revision No. 1
Revision Date: 5/24/2024

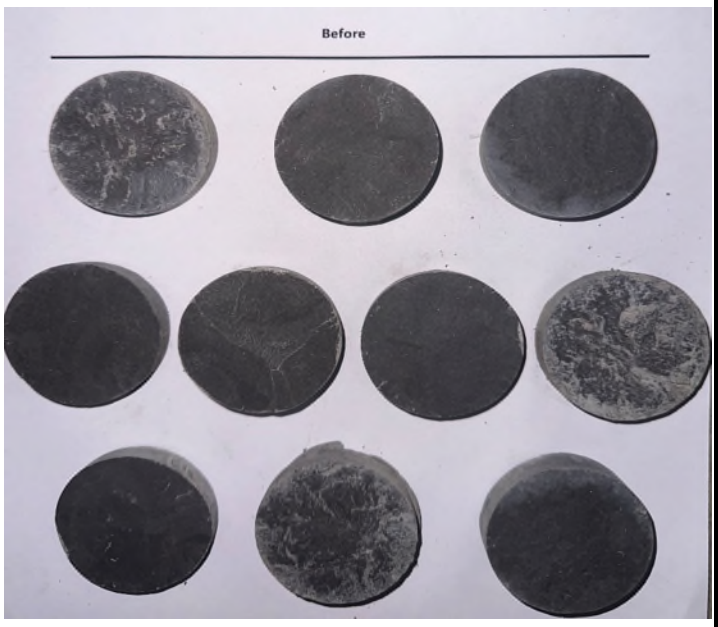
Slake Durability of Shales and Weak Rocks

ASTM D4644

S&ME, Inc. - Columbus: 6190 Enterprise Court, Dublin, Ohio 43016

Project Number:	22170059B	Report Date:	6/14/24
Project Name:	LAK-90-2.93 Slope Repair	Test Date(s):	6/10-13/2024
Client Name:	WSP	Received Date:	5/17/2024
Client Address:	2 Miranova Place, Suite 450, Columbus, O		
Boring:	B-005-1-23 Sample #: NQ-5	Sample Date:	5/13/2024
		Depth:	44.2'-49.2'
Sample Description:	SHALE, gray		

Specimen Pictures Before Testing



Specimen Pictures After Testing

Fragment Type: ☐ **I** (Unchanged) ☑ **II** (large and small) ☐ **III** (exclusively small)

Record comments, notes, and deviations from the test procedure:

Tested By:	Paula J. Manning	Date:	6/14/2024
	Signature		
Reviewed by:	Christina Jauregui	Date:	6/14/2024
	Signature		

Form No: TR-D4644-1
Revision No. 1
Revision Date: 5/24/2024

Slake Durability of Shales and Weak Rocks

ASTM D4644

S&ME, Inc. - Columbus: 6190 Enterprise Court, Dublin, Ohio 43016

Project Number:	22170059B	Report Date:	6/14/24
Project Name:	LAK-90-2.93 Slope Repair	Test Date(s):	6/10-13/2024
Client Name:	WSP		
Client Address:	2 Miranova Place, Suite 450, Columbus, OH 43215		
Boring:	B-008-4-23	Sample #:	NQ-2
Sample Date:	5/13/2024		
Depth:	52.0'-56.3'		
Sample Description:	SHALE, gray		

Equipment Used:

Slake Durability Machine:	S&ME ID#:	28074	Drum (g):	829.27	Calibration Date:	5/16/24
Timer:	S&ME ID#:	29622	Readability:	1 second	Calibration Date:	1/8/24
Balance (1g):	S&ME ID#:	27984	Readability:	0.01 g	Calibration Date:	10/19/23

Mass of Individual Rock Fragments Before Testing without Drum included (grams)

Fragment No. 1:	57.15	Fragment No. 2:	56.86	Fragment No. 3:	54.89	
Fragment No. 4:	55.02	Fragment No. 5:	55.79	Fragment No. 6:	51.16	
Fragment No. 7:	55.52	Fragment No. 8:	58.05	Fragment No. 9:	47.87	
Fragment No. 10:	57.35			Total Masses:	549.66	(Tolerance: 450-550)

Initial Moisture Content of Rock Fragments:

Total Masses of Fragments Before Testing and Drum (g):	1378.93
Total Masses of Fragments After Drying and Drum (g):	1352.60
Water Content of Rock Fragments (g):	26.33
Moisture Content of Rock Fragments:	**4.8%**

Water Temperatures

Water Temperature at the beginning of the cycle:	21.7	°c
Water Temperature at the end of the cycle:	21.7	°c
Average Water Temperature:	**21.7**	°c

Moisture Content of Rock Fragments By Cycle

	Cycle 1	Cycle 2
Total Masses of Fragments After Drying and Drum (g):	1187.13	1093.94

Slake Durability Indexes

First Cycle Index:	68.4%
Second Cycle Index:	**50.6%**

Record comments, notes, and deviations from the test procedure:

ASTM D4644: Slake Durability of Shales and Other Similar Weak Rocks.

Tested By:	Paula J. Manning	Date:	6/14/2024
	Signature		
Reviewed by:	Christina Jauregui	Date:	6/14/2024
	Signature		

Form No: TR-D4644-2
Revision No. 1
Revision Date: 5/24/2024

Slake Durability of Shales and Weak Rocks

ASTM D4644

S&ME, Inc. - Columbus: 6190 Enterprise Court, Dublin, Ohio 43016

Project Number:	22170059B	Report Date:	6/14/24
Project Name:	LAK-90-2.93 Slope Repair	Test Date(s):	6/10-13/2024
Client Name:	WSP	Received Date:	5/17/2024
Client Address:	2 Miranova Place, Suite 450, Columbus, O		
Boring:	B-008-4-23 Sample #: NQ-2	Sample Date:	5/13/2024
		Depth:	52.0'-56.3'
Sample Description:	SHALE, gray		

Specimen Pictures Before Testing

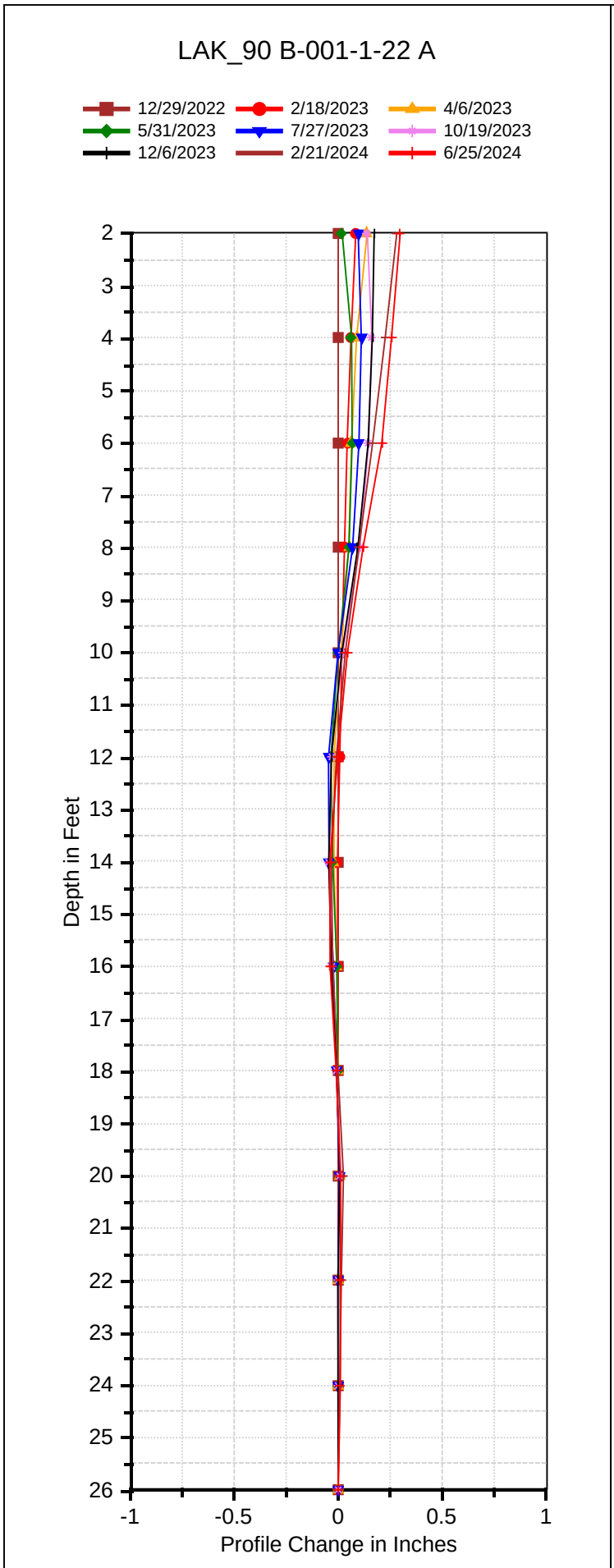
Specimen Pictures After Testing

Fragment Type: ☐ **I** (Unchanged) ☐ **II** (large and small) ☑ **III** (exclusively small)

Record comments, notes, and deviations from the test procedure:

Tested By:	Paula J. Manning	Paula J Manning *Signature*	Date:	6/14/2024
Reviewed by:	Christina Jauregui	Christina Jauregui *Signature*	Date:	6/14/2024

Appendix III – Field Instrument Readings


LAK_90 B-001-1-22 A
12/29/2022
2/18/2023
4/6/2023
5/31/2023
7/27/2023
10/19/2023
12/6/2023
2/21/2024
6/25/2024
Depth in Feet
Profile Change in Inches

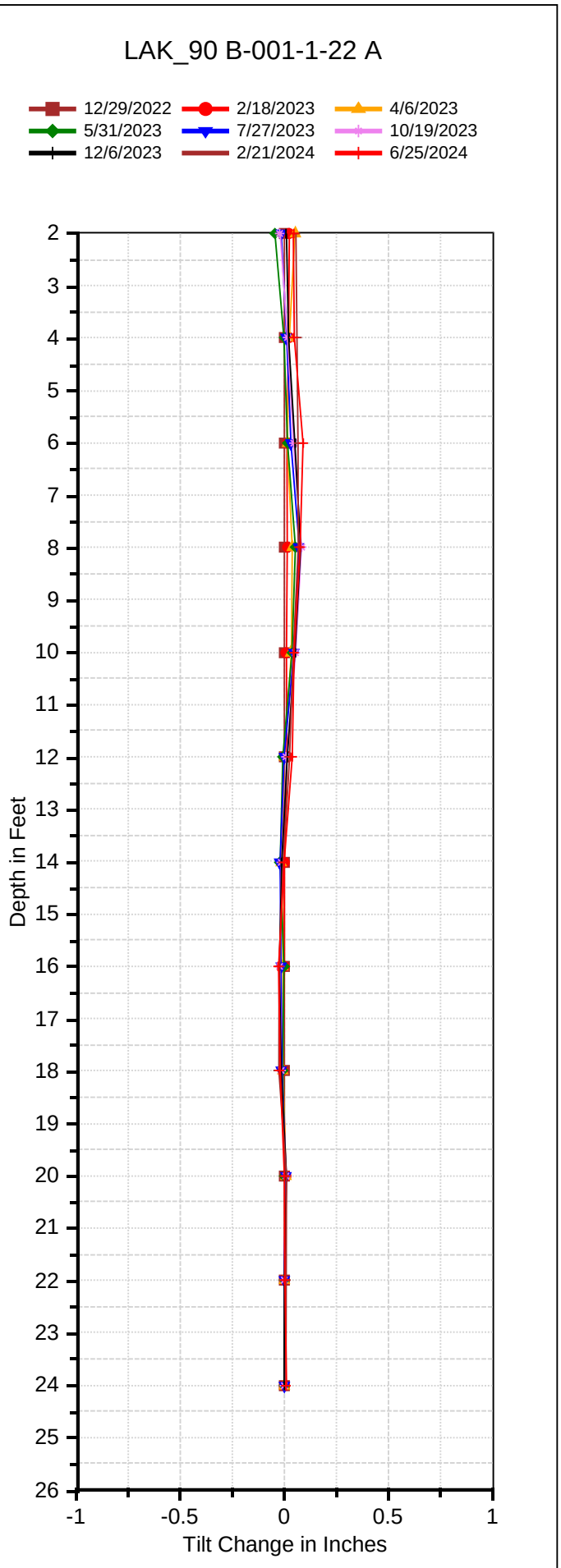
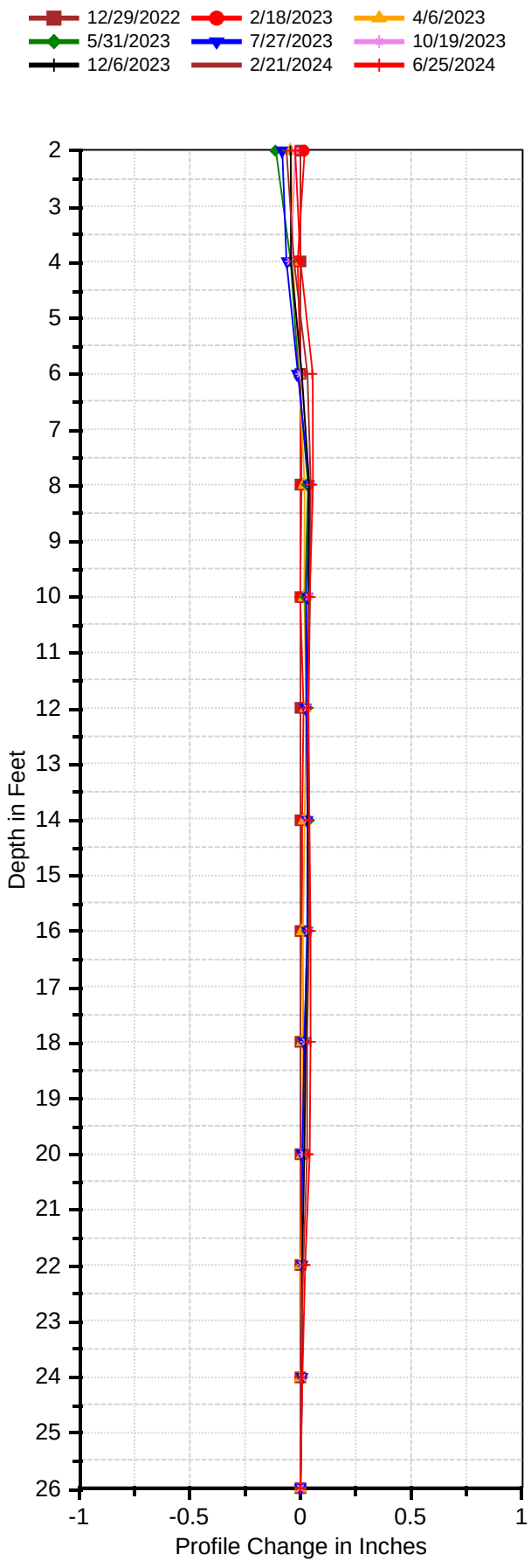

LAK_90 B-001-1-22 A
12/29/2022
2/18/2023
4/6/2023
5/31/2023
7/27/2023
10/19/2023
12/6/2023
2/21/2024
6/25/2024
Depth in Feet
Tilt Change in Inches

PLATE 1


LAK_90 B-001-1-22 B
12/29/2022
2/18/2023
4/6/2023
5/31/2023
7/27/2023
10/19/2023
12/6/2023
2/21/2024
6/25/2024
Depth in Feet
Profile Change in Inches

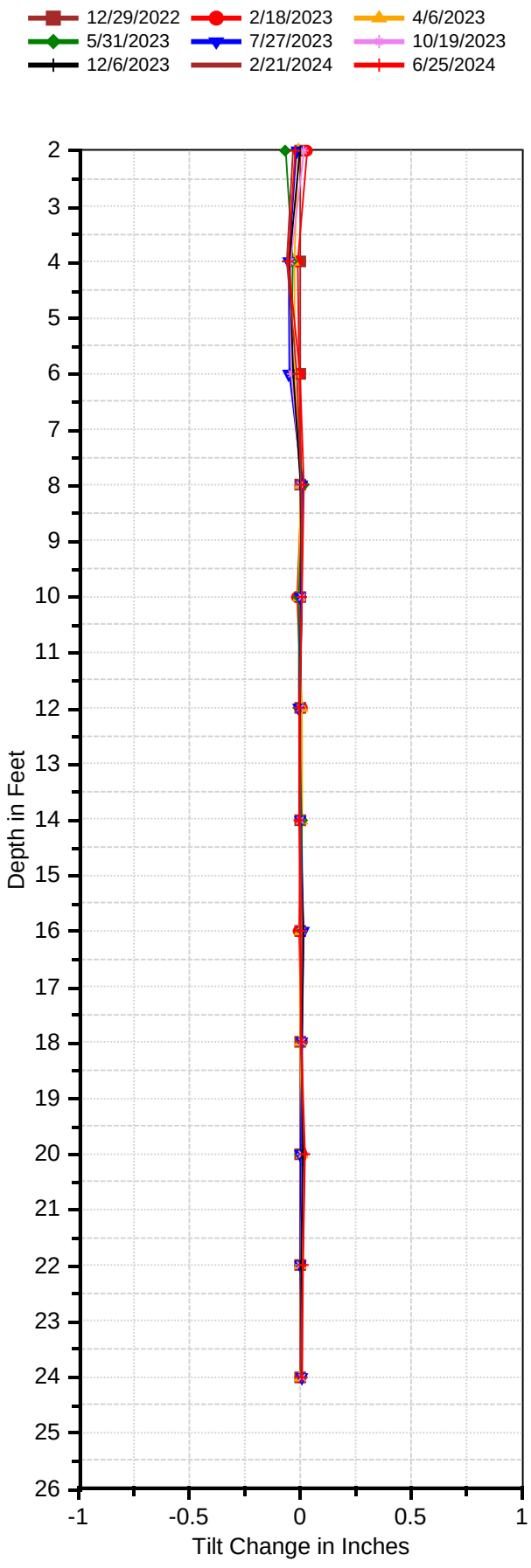

LAK_90 B-001-1-22 B
12/29/2022
2/18/2023
4/6/2023
5/31/2023
7/27/2023
10/19/2023
12/6/2023
2/21/2024
6/25/2024
Depth in Feet
Tilt Change in Inches

PLATE 2

MONITORING WELL READINGS

B-001-1-22 (offset)				
Date	Time	Water Level (ft)		Notes
		From Top of Pipe	From Ground Surface	
12/7/2022	--			Seepage noted at depth of 4.2 feet during drilling
12/29/2022	--	10.8	8.4	Stick-up Height of Casing = 2.4 feet
12/29/2022	--	15.8	13.4	Bailed to this depth
2/18/2023	--	8.6	6.2	
4/6/2023	12:00PM	8.9	6.5	
7/27/2023	--	7.7	5.3	
10/19/2023	--	8.3	5.9	
12/6/2023	--	7.1	4.7	
2/21/2024	--	6.5	4.1	
4/17/2024	--	9.6	7.2	
6/25/2024	--	8.5	6.1	

MONITORING WELL READINGS

B-005-0-22				
Date	Time	Water Level (ft)		Notes
		From Top of Pipe	From Ground Surface	
12/13/2022	--	--	24.2	Groundwater depth during drilling
12/29/2022	--	26.7	24.4	Stick-up Height of Casing = 2.3 feet
12/29/2022	--	27.8	25.5	Bailed to this depth
2/18/2023	--	25.2	22.9	
4/6/2023	12:00PM	25.2	22.9	
7/27/2023	--	24.4	22.1	
10/19/2023	--	24.7	22.4	
12/6/2023	--	23.9	21.6	
2/21/2024	--	22.4	20.1	
4/17/2024	--	24.5	22.2	
6/25/2024	--	24.8	22.5	

MONITORING WELL READINGS

B-008-1-22				
Date	Time	Water Level (ft)		Notes
		From Top of Pipe	From Ground Surface	
7/17/2023	--	--	38.2	Groundwater depth during drilling
7/27/2023	--	40.5	37	Stick-up Height of Casing = 3.5 feet
				Bailing not needed
10/19/2023	--	39.8	36.3	
12/6/2023	--	39.4	35.9	
2/21/2024	--	38.1	34.6	
4/17/2024	--	41	37.5	Well abandoned on 5/13/24.

MONITORING WELL READINGS

B-009-1-23				
Date	Time	Water Level (ft)		Notes
		From Top of Pipe	From Ground Surface	
5/22/2024	--	--	48.0	Groundwater depth during drilling
6/25/2024	--	50.5	47.0	Stick-up Height of Casing = 3.5 feet
				Bailing not needed

APPENDIX

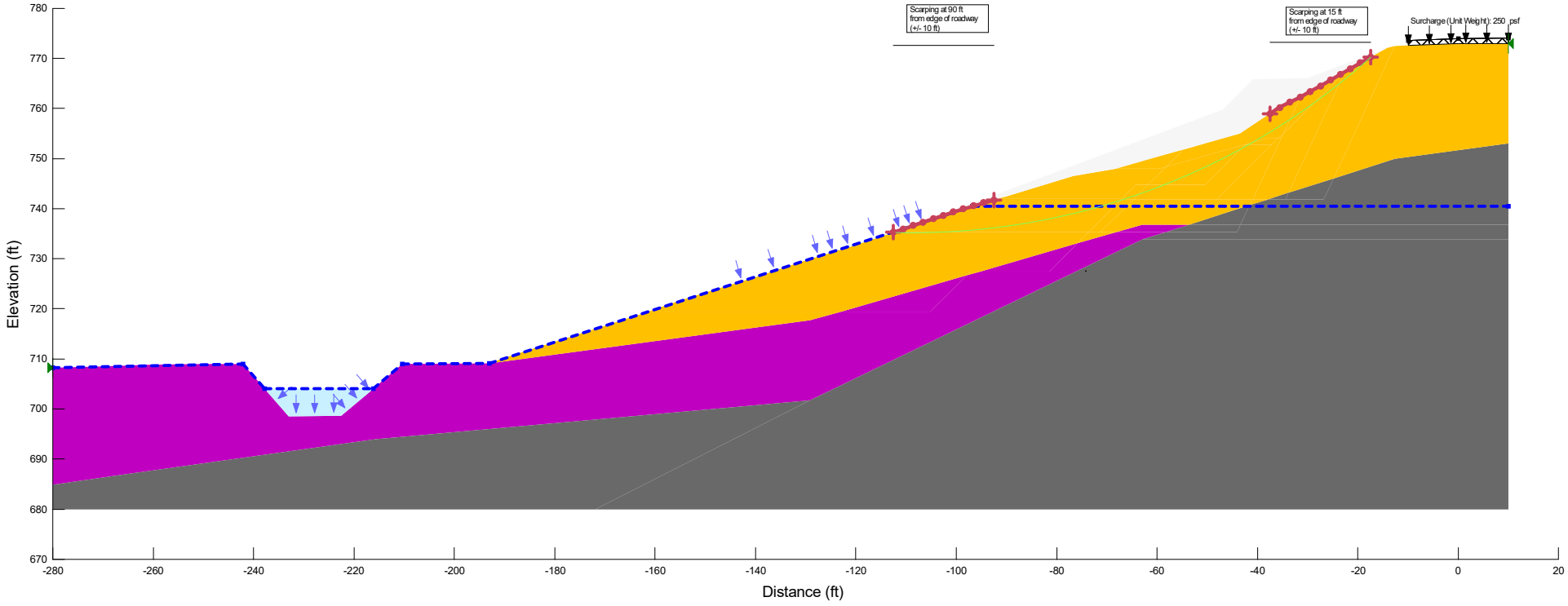
B SLOPE STABILITY CALCULATIONS

APPENDIX

B-1 SLOPE/W OUTPUT - STATION 102+18.28

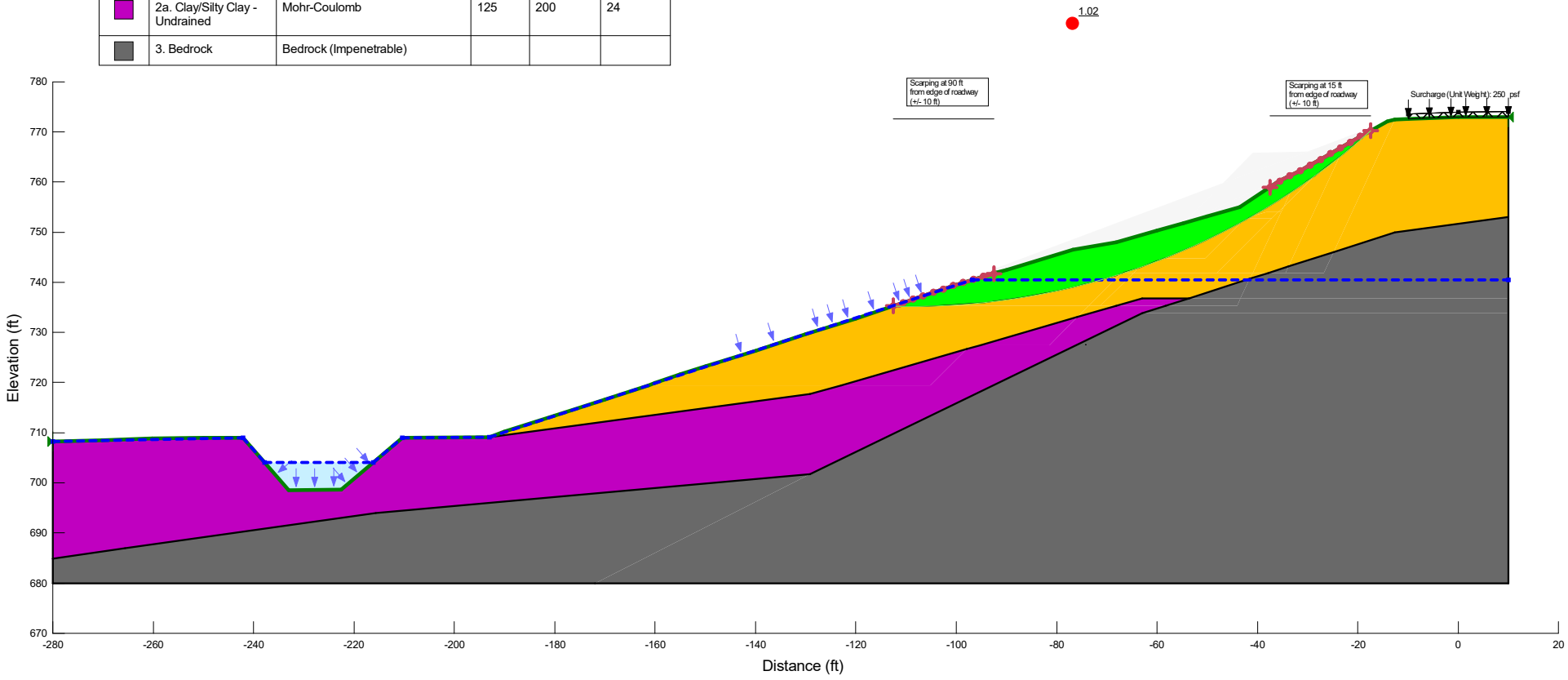
File Name: LAK-90-2.93_Section-1_Sta.20+50 - 052523.gsz
Name: 0a. Existing Condition - Undrained (2)
Created By: El-Quqa, Osama O.
Date: 05/25/2023
Analysis Type: Morgenstern-Price

Color	Name	Slope Stability Material Model	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)
	1c. Fill (Residual Strength)	Mohr-Coulomb	120	0	20
	2a. Clay/Silty Clay - Undrained	Mohr-Coulomb	125	200	24
	3. Bedrock	Bedrock (Impenetrable)			



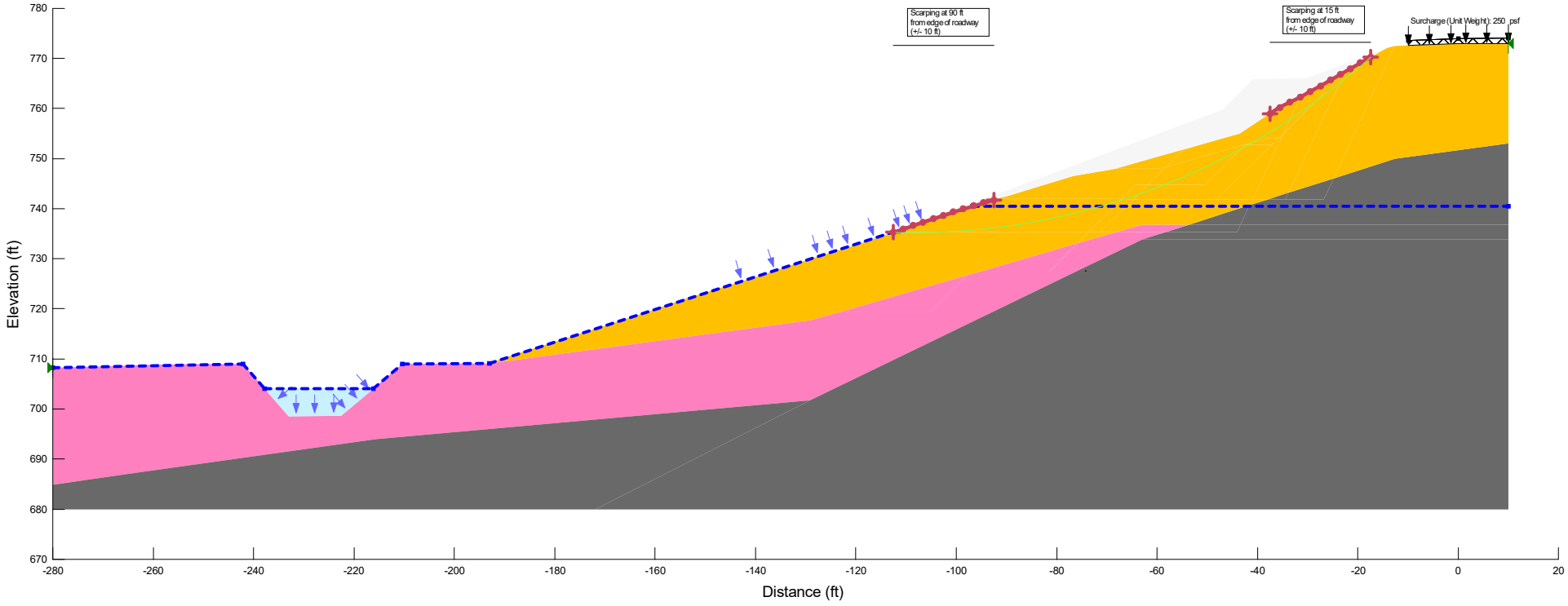
File Name: LAK-90-2.93_Section-1_Sta.20+50 - 052523.gsz
Name: 0a. Existing Condition - Undrained (2)
Created By: El-Quqa, Osama O.
Date: 05/25/2023
Analysis Type: Morgenstern-Price

Color	Name	Slope Stability Material Model	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)
	1c. Fill (Residual Strength)	Mohr-Coulomb	120	0	20
	2a. Clay/Silty Clay - Undrained	Mohr-Coulomb	125	200	24
	3. Bedrock	Bedrock (Impenetrable)			



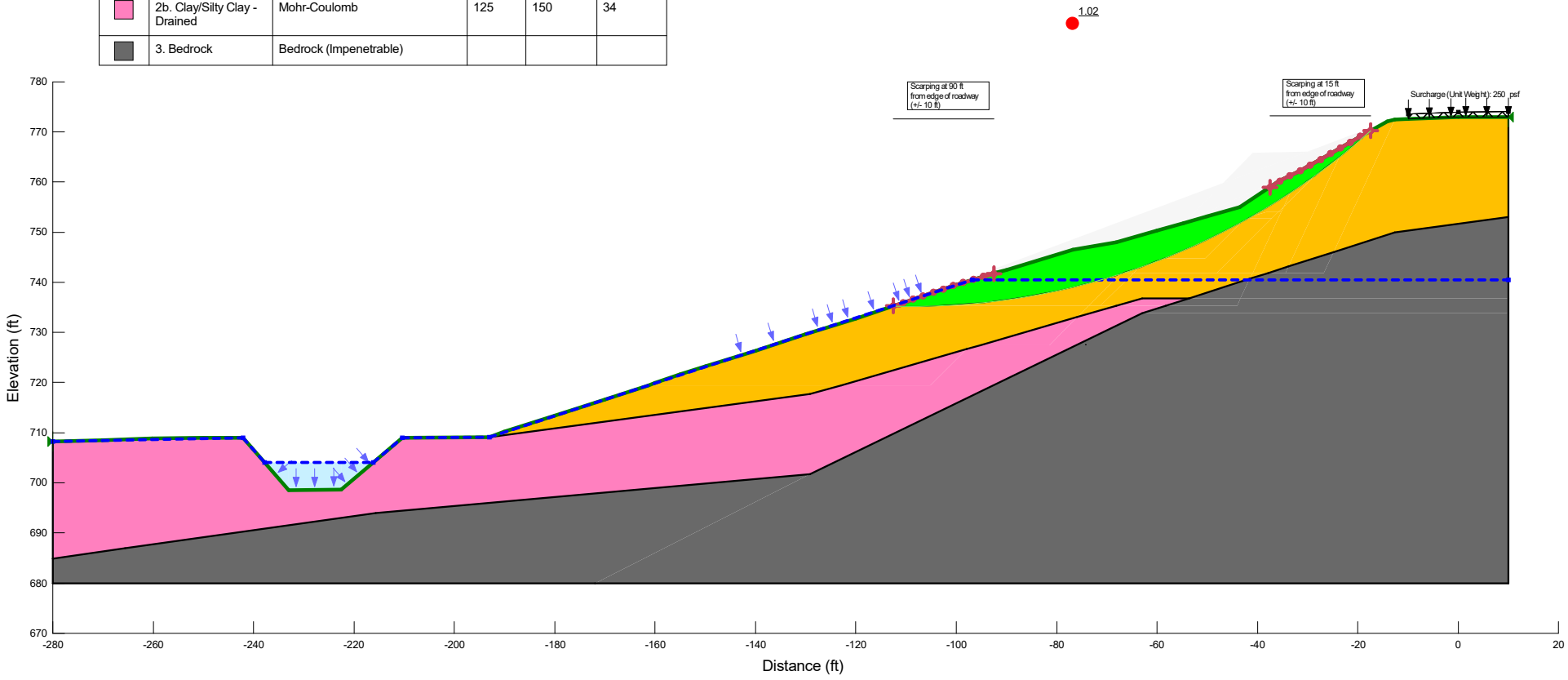
File Name: LAK-90-2.93_Section-1_Sta.20+50 - 052523.gsz
Name: 0b. Existing Condition - Drained (2)
Created By: El-Quqa, Osama O.
Date: 05/25/2023
Analysis Type: Morgenstern-Price

Color	Name	Slope Stability Material Model	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)
	1c. Fill (Residual Strength)	Mohr-Coulomb	120	0	20
	2b. Clay/Silty Clay - Drained	Mohr-Coulomb	125	150	34
	3. Bedrock	Bedrock (Impenetrable)			



File Name: LAK-90-2.93_Section-1_Sta.20+50 - 052523.gsz
Name: 0b. Existing Condition - Drained (2)
Created By: El-Quqa, Osama O.
Date: 05/25/2023
Analysis Type: Morgenstern-Price

Color	Name	Slope Stability Material Model	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)
	1c. Fill (Residual Strength)	Mohr-Coulomb	120	0	20
	2b. Clay/Silty Clay - Drained	Mohr-Coulomb	125	150	34
	3. Bedrock	Bedrock (Impenetrable)			

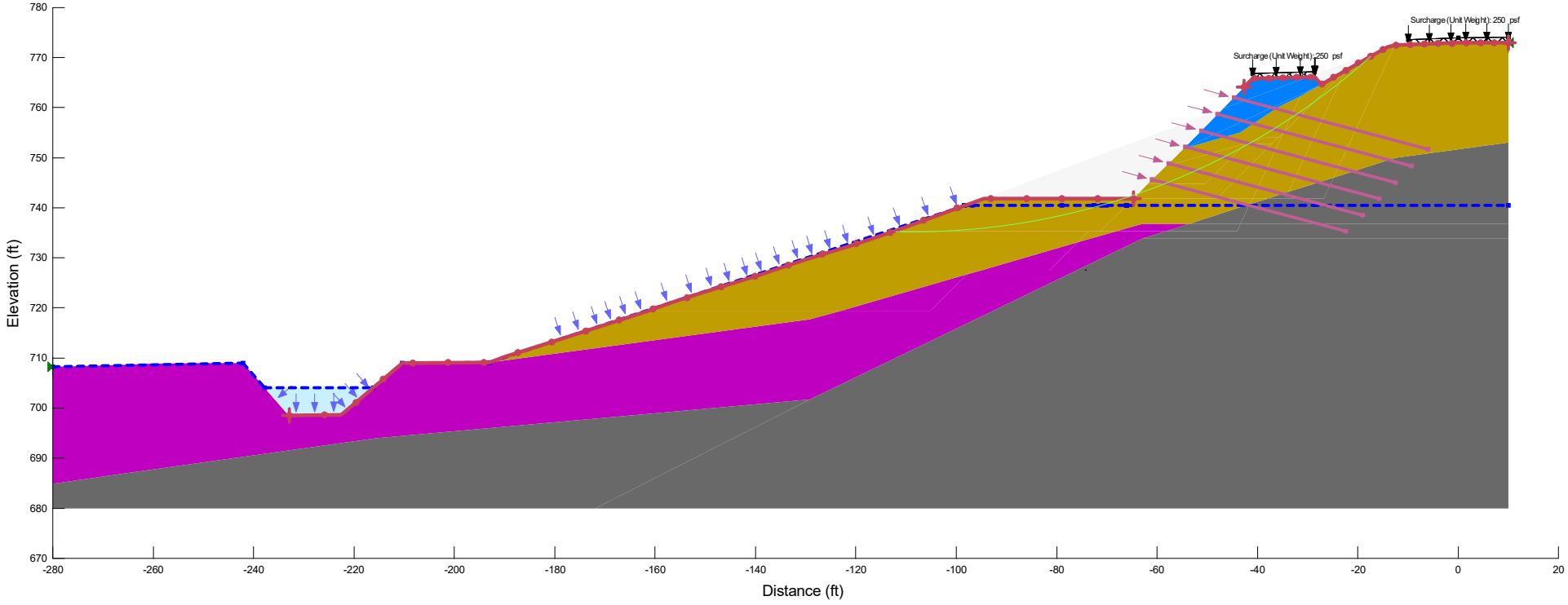


File Name: LAK-90-2.93_Section-1_Sta.102+18.28 - 053023.gsz
Name: 3a. Remediation - Soil Nails - Undrained (2)
Created By: El-Quqa, Osama O.
Last Edited By: Saqer, Hamzeh
Date: 08/16/2024
Analysis Type: Morgenstern-Price

Color	Name	Slope Stability Material Model	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)
	1a. Fill - Undrained	Mohr-Coulomb	120	200	21
	2a. Clay/Silty Clay - Undrained	Mohr-Coulomb	125	200	24
	3. Bedrock	Bedrock (Impenetrable)			
	5. A-6a Borrow Source Material - Undrained	Mohr-Coulomb	110	2,500	0

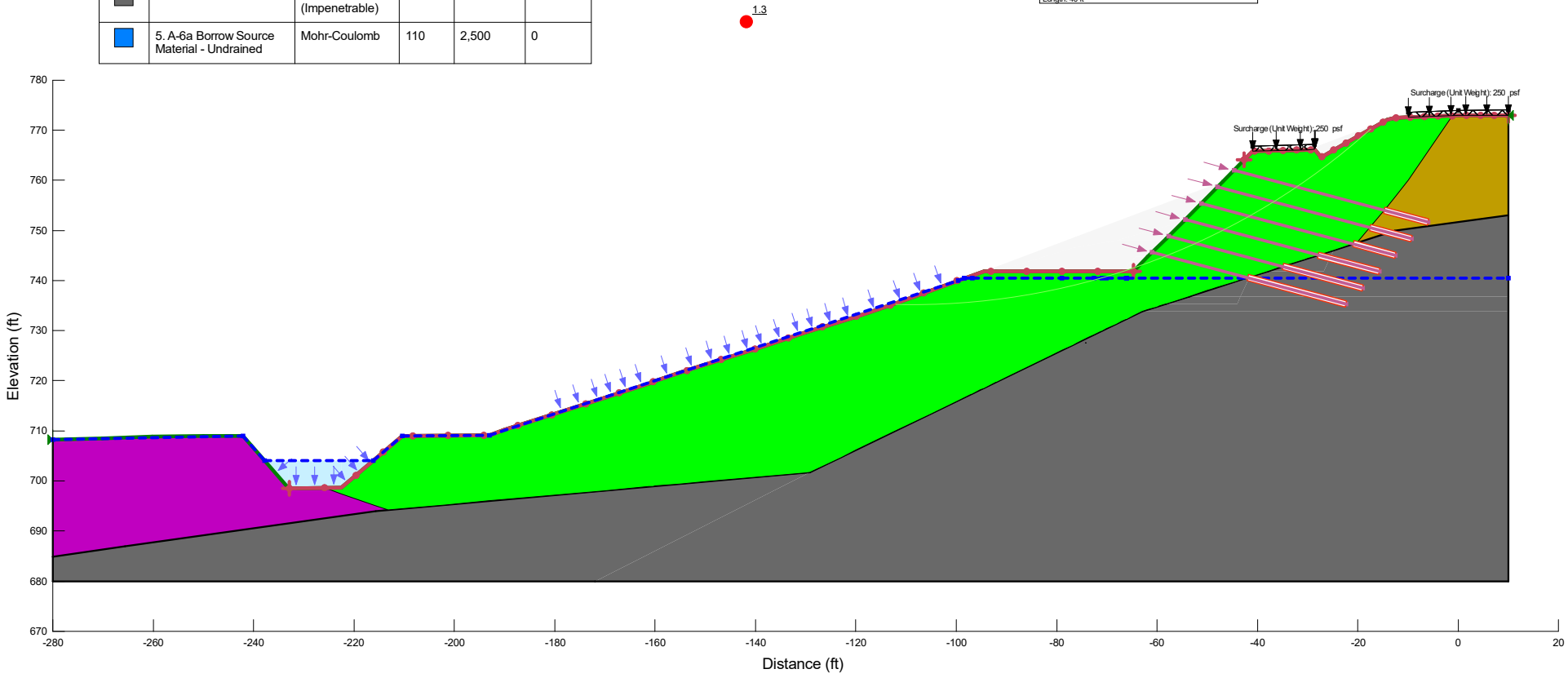
Name: Soil Nails
Pullout Resistance: 720 psf
Pullout Resistance Reduction Factor: 1.5
Tensile Capacity: 387,000 lbf
Tensile Capacity Reduction Factor: 1.35
Shear Force: 0 lbf
Shear Force Reduction Factor: 1

Distance Between Reinforcements (along ground surface): 4 ft
Out-of-Plane Spacing: 4 ft
Bond Diameter: 0.33 ft
Orientation: -15 °
Length: 40 ft



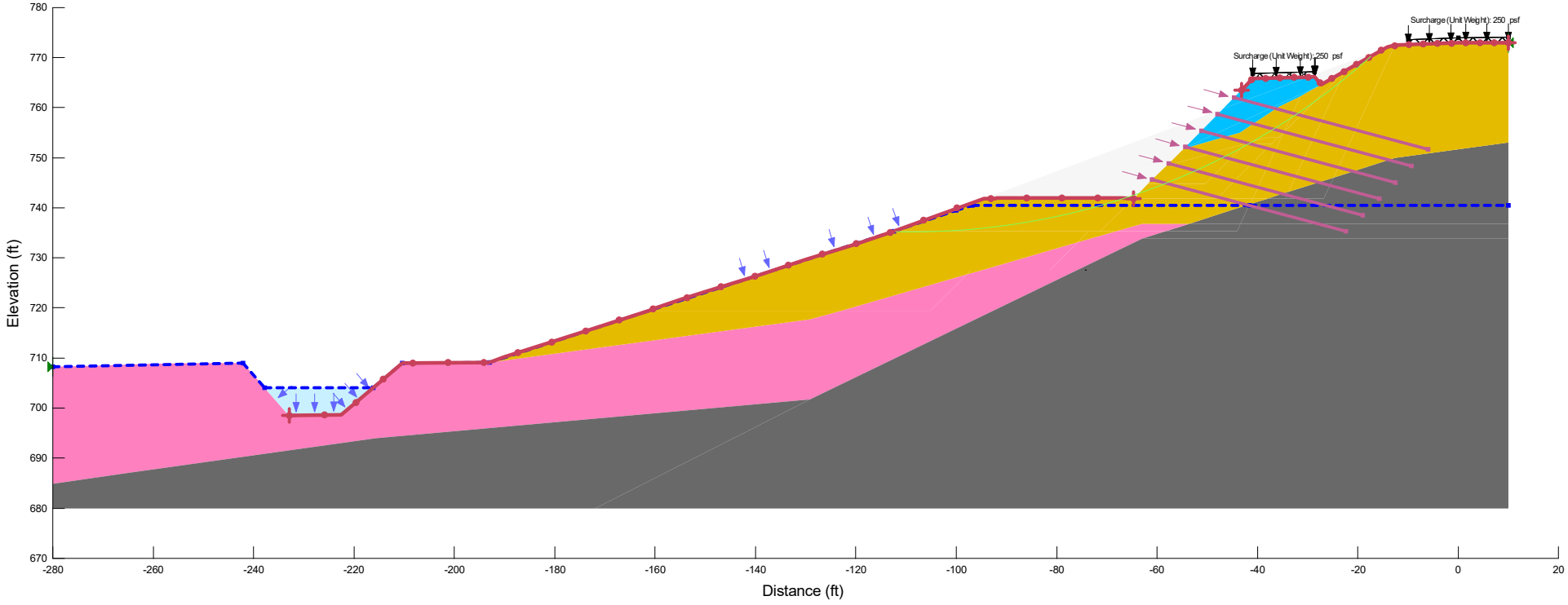
File Name: LAK-90-2.93_Section-1_Sta.102+18.28 - 053023.gsz
Name: 3a. Remediation - Soil Nails - Undrained (2)
Created By: El-Quqa, Osama O.
Last Edited By: Saqer, Hamzeh
Date: 08/16/2024
Analysis Type: Morgenstern-Price

Color	Name	Slope Stability Material Model	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)
	1a. Fill - Undrained	Mohr-Coulomb	120	200	21
	2a. Clay/Silty Clay - Undrained	Mohr-Coulomb	125	200	24
	3. Bedrock	Bedrock (Impenetrable)			
	5. A-6a Borrow Source Material - Undrained	Mohr-Coulomb	110	2,500	0



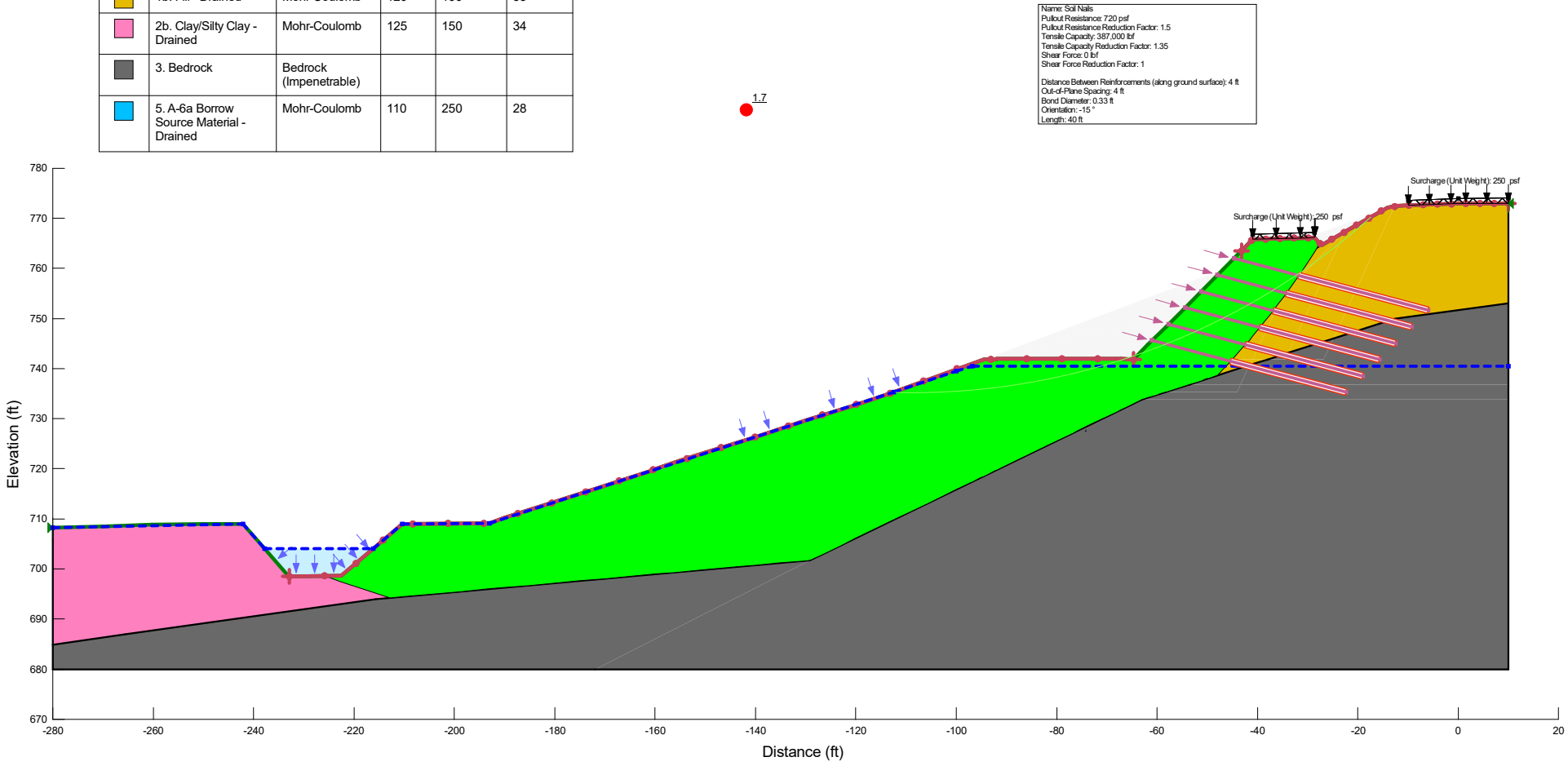
File Name: LAK-90-2.93_Section-1_Sta.102+18.28 - 053023.gsz
Name: 3b. Remediation - Soil Nails - Drained (2)
Created By: El-Quqa, Osama O.
Last Edited By: Saqer, Hamzeh
Date: 08/16/2024
Analysis Type: Morgenstern-Price

Color	Name	Slope Stability Material Model	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)
	1b. Fill - Drained	Mohr-Coulomb	120	100	33
	2b. Clay/Silty Clay - Drained	Mohr-Coulomb	125	150	34
	3. Bedrock	Bedrock (Impenetrable)			
	5. A-6a Borrow Source Material - Drained	Mohr-Coulomb	110	250	28



File Name: LAK-90-2.93_Section-1_Sta.102+18.28 - 053023.gsz
Name: 3b. Remediation - Soil Nails - Drained (2)
Created By: El-Quqa, Osama O.
Last Edited By: Saqer, Hamzeh
Date: 08/16/2024
Analysis Type: Morgenstern-Price

Color	Name	Slope Stability Material Model	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)
	1b. Fill - Drained	Mohr-Coulomb	120	100	33
	2b. Clay/Silty Clay - Drained	Mohr-Coulomb	125	150	34
	3. Bedrock	Bedrock (Impenetrable)			
	5. A-6a Borrow Source Material - Drained	Mohr-Coulomb	110	250	28

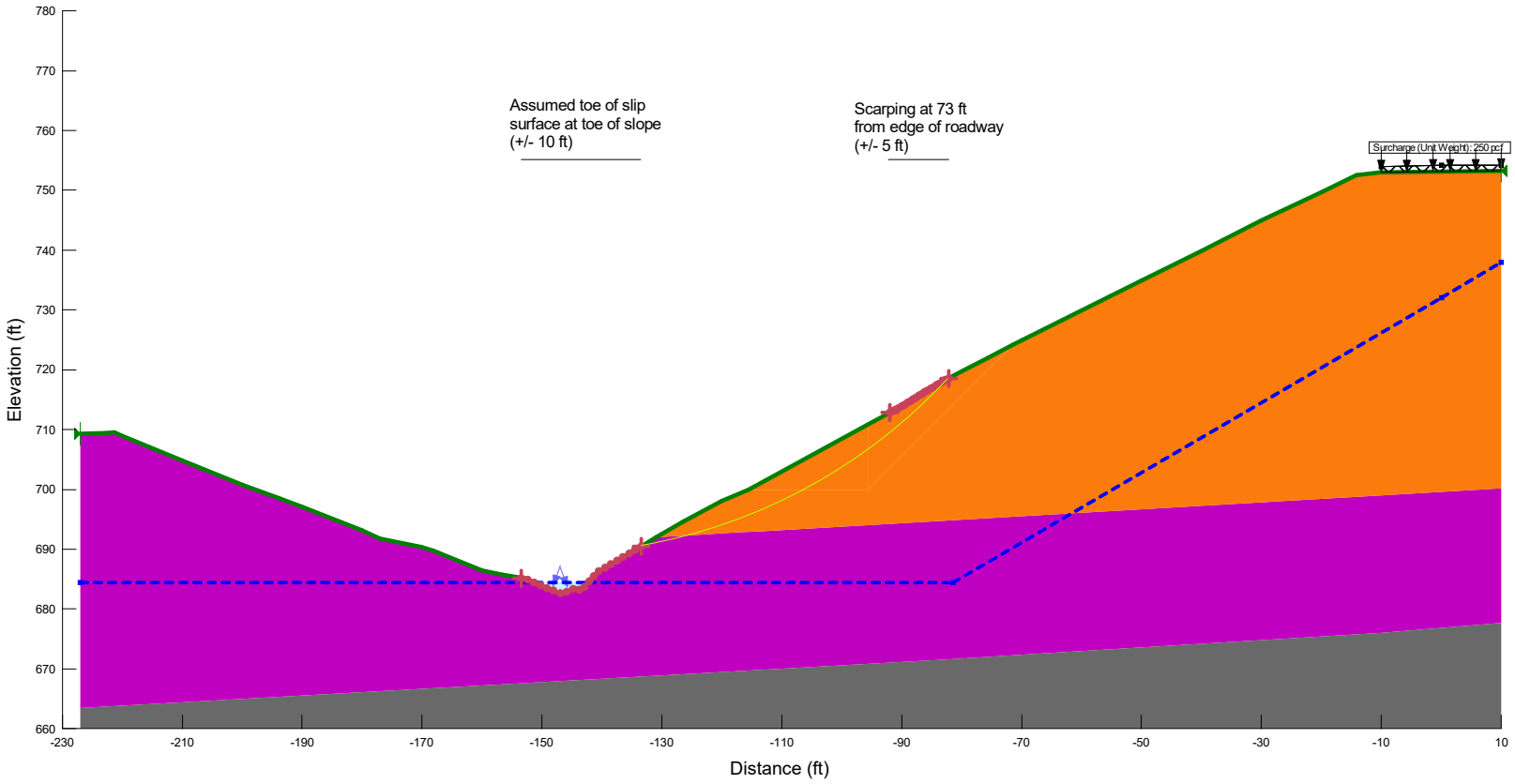


APPENDIX

B-2 SLOPE/W OUTPUT - STATION 112+49.46

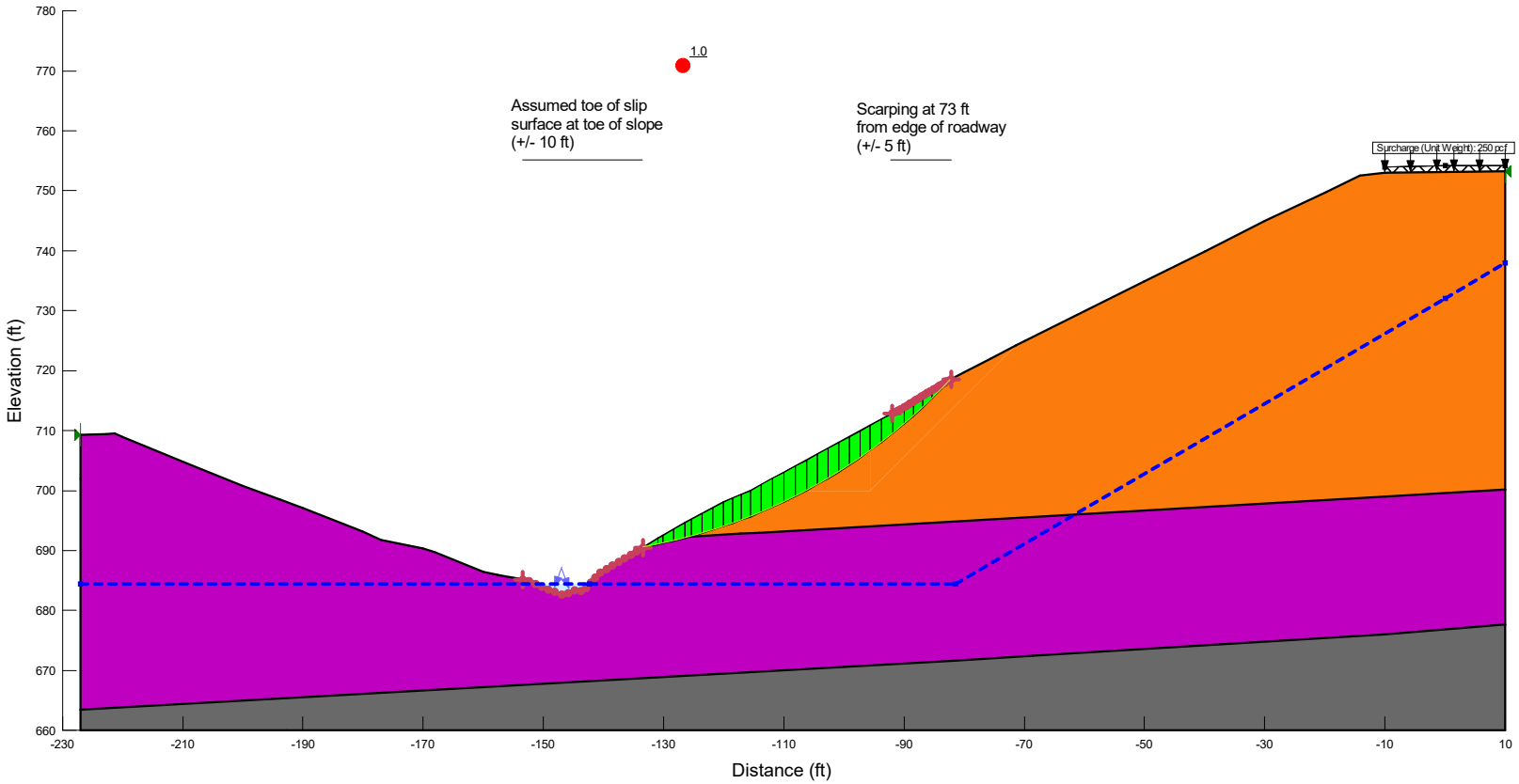
File Name: LAK-90-2.93_Section-2_Sta.31+00_08-06-24.gsz
Name: 0a. Existing Condition - Undrained
Last Edited By: Saqer, Hamzeh
Created By: El-Quqa, Osama O.
Date: 08/16/2024
Analysis Type: Morgenstern-Price

Color	Name	Slope Stability Material Model	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)
	1c. Residual Fill	Mohr-Coulomb	120	0	23
	2a. Clay/Silty Clay - Undrained	Mohr-Coulomb	125	200	24
	3. Bedrock	Bedrock (Impenetrable)			



File Name: LAK-90-2.93_Section-2_Sta.31+00_08-06-24.gsz
Name: 0a. Existing Condition - Undrained
Last Edited By: Saqer, Hamzeh
Created By: El-Quqa, Osama O.
Date: 08/16/2024
Analysis Type: Morgenstern-Price

Color	Name	Slope Stability Material Model	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)
	1c. Residual Fill	Mohr-Coulomb	120	0	23
	2a. Clay/Silty Clay - Undrained	Mohr-Coulomb	125	200	24
	3. Bedrock	Bedrock (Impenetrable)			



File Name: LAK-90-2.93_Section-2_Sta.31+00_08-06-24.gsz
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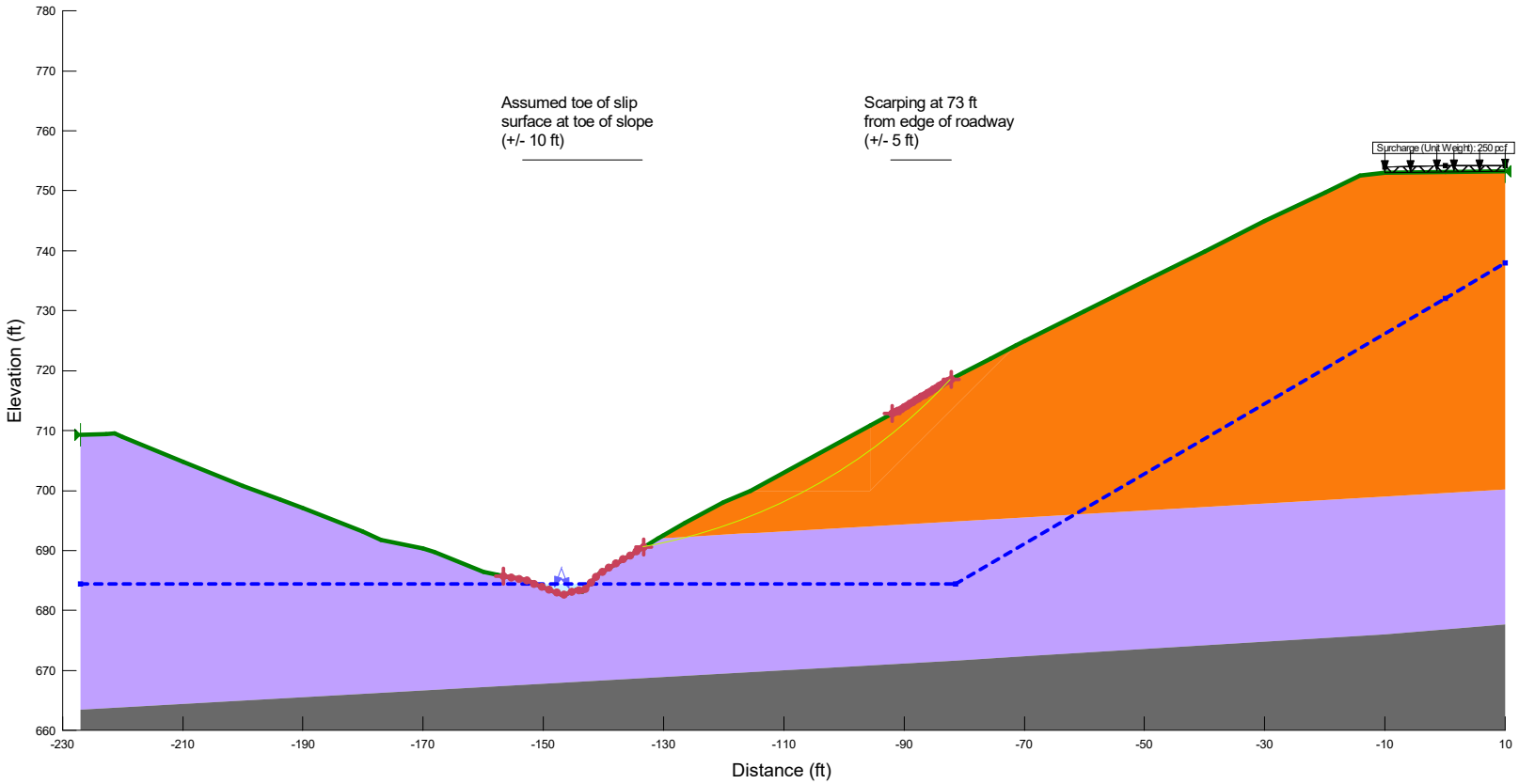
Last Edited By: Saqer, Hamzeh
Created By: El-Quqa, Osama O.
Date: 08/16/2024
Analysis Type: Morgenstern-Price

Color	Name	Slope Stability Material Model	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)
	1c. Residual Fill	Mohr-Coulomb	120	0	23
	2c. Clay/Silty Clay - Residual	Mohr-Coulomb	125	50	32
	3. Bedrock	Bedrock (Impenetrable)			



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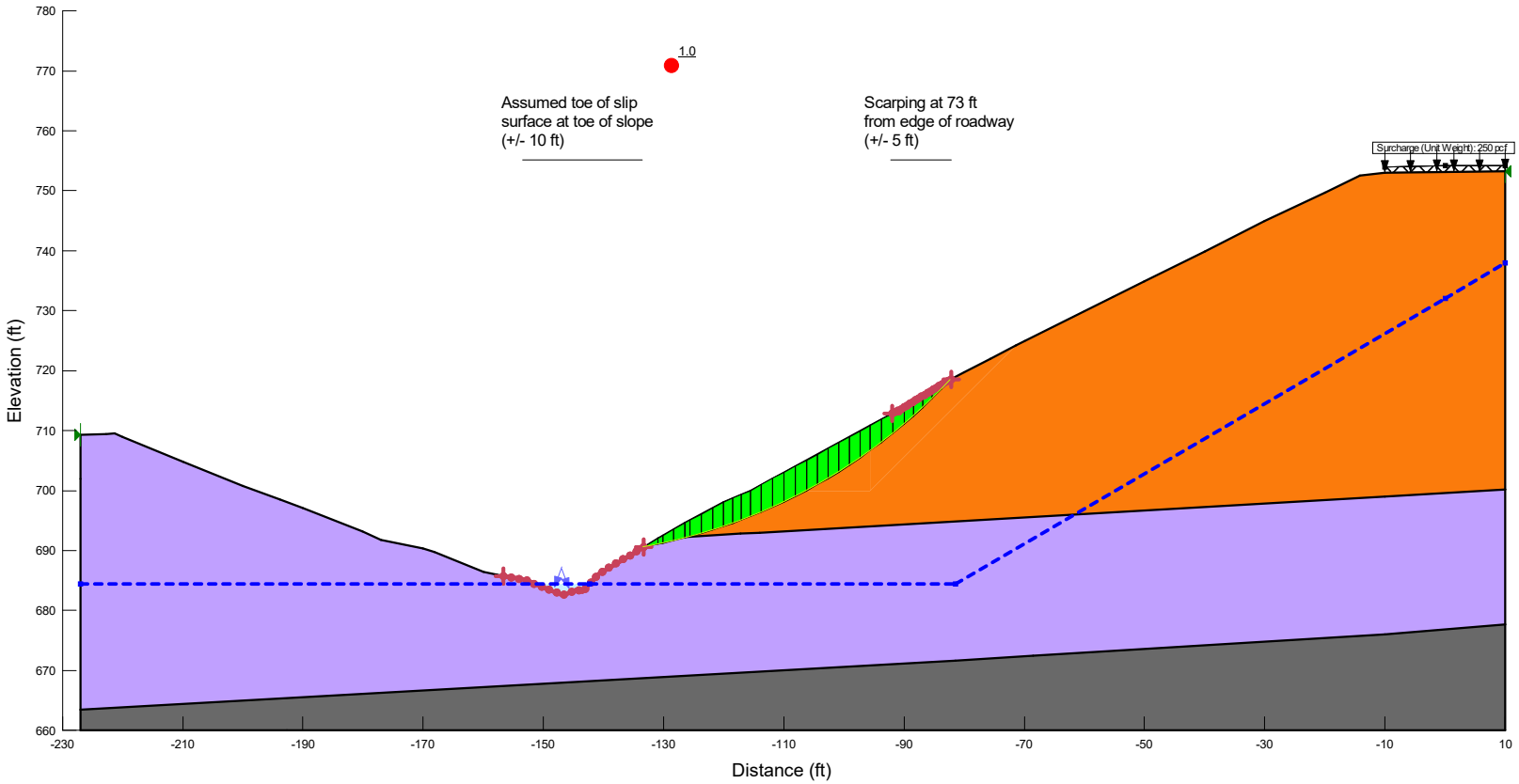
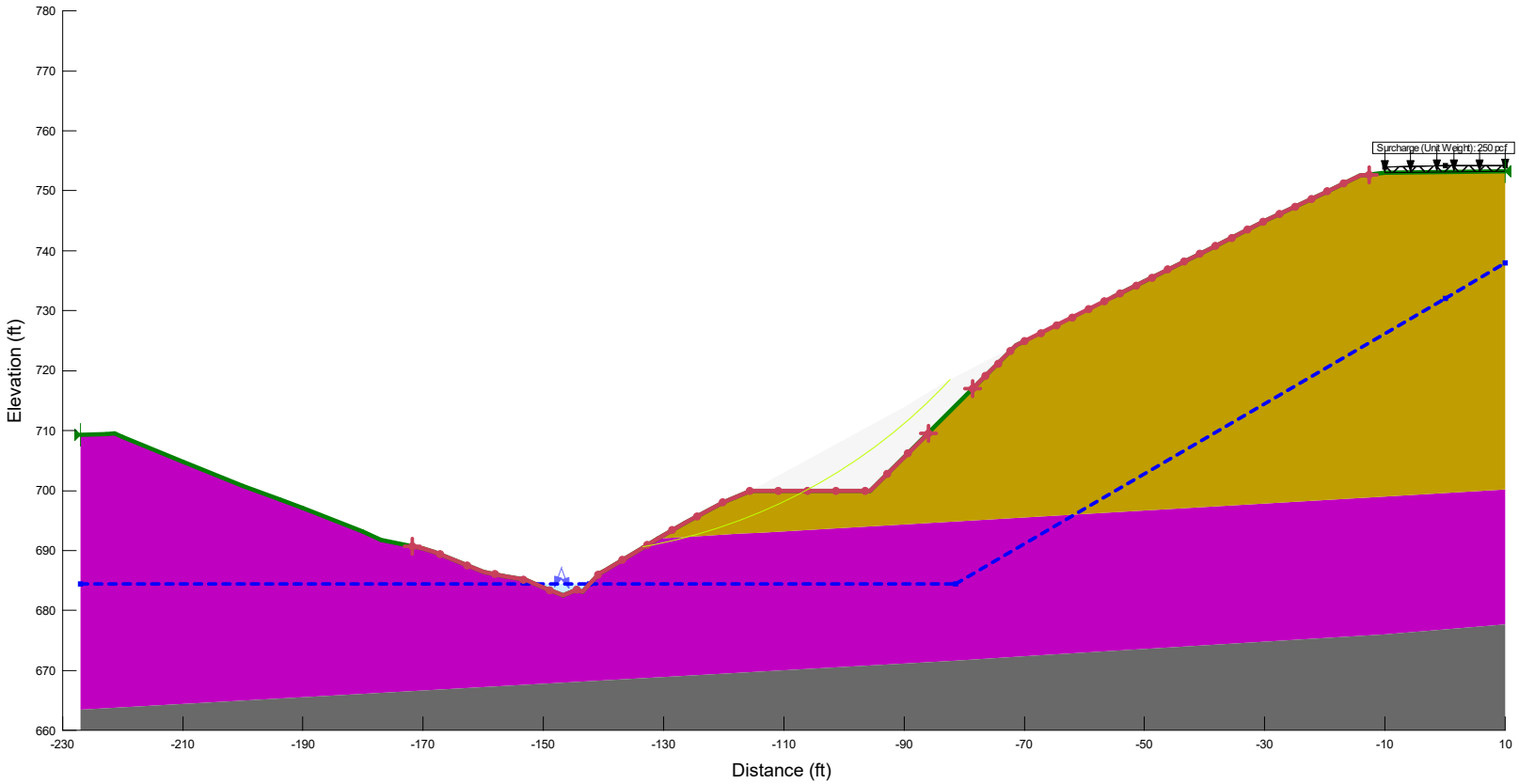
Name: 0b. Existing Condition - Drained
Last Edited By: Saqer, Hamzeh
Created By: El-Quqa, Osama O.
Date: 08/16/2024
Analysis Type: Morgenstern-Price

Color	Name	Slope Stability Material Model	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)
	1c. Residual Fill	Mohr-Coulomb	120	0	23
	2c. Clay/Silty Clay - Residual	Mohr-Coulomb	125	100	32
	3. Bedrock	Bedrock (Impenetrable)			



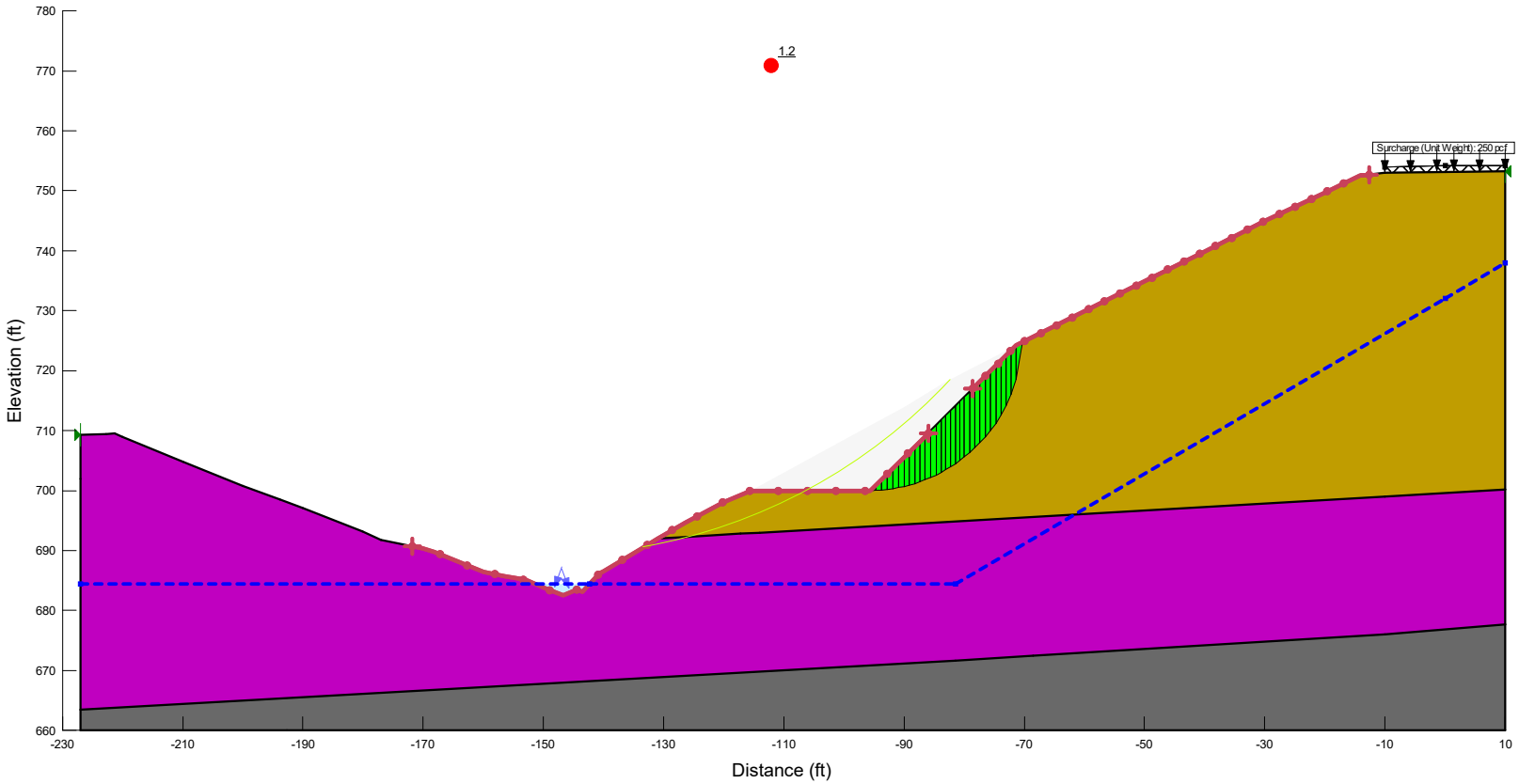
File Name: LAK-90-2.93_Section-2_Sta.31+00_08-06-24.gsz
Name: 1a. Temporary Bench with Slope 1:1
Last Edited By: Saqer, Hamzeh
Created By: El-Quqa, Osama O.
Date: 08/16/2024
Analysis Type: Morgenstern-Price

Color	Name	Slope Stability Material Model	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)
	1a. Fill - Undrained	Mohr-Coulomb	120	200	23
	2a. Clay/Silty Clay - Undrained	Mohr-Coulomb	125	200	24
	3. Bedrock	Bedrock (Impenetrable)			



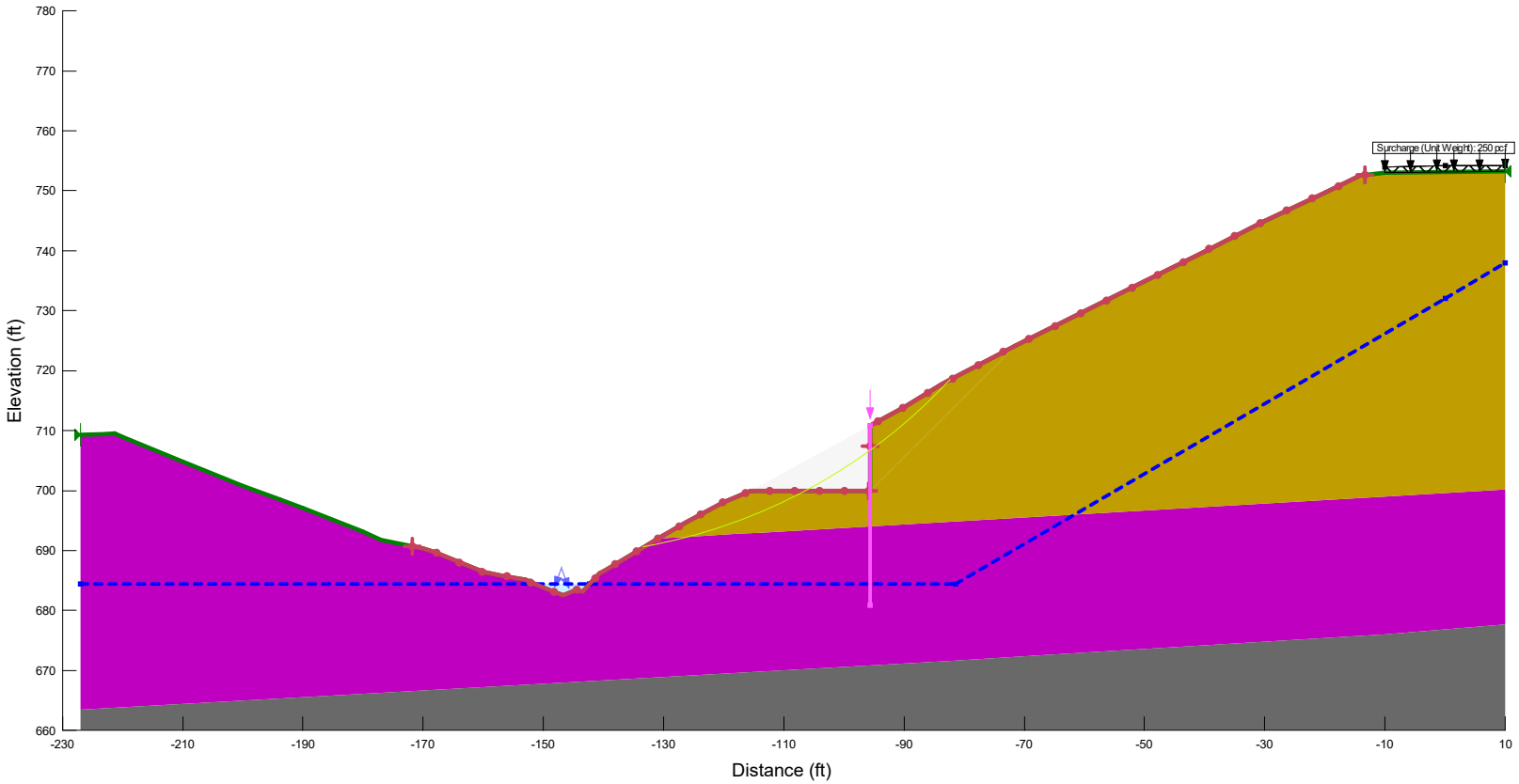
File Name: LAK-90-2.93_Section-2_Sta.31+00_08-06-24.gsz
Name: 1a. Temporary Bench with Slope 1:1
Last Edited By: Saqer, Hamzeh
Created By: El-Quqa, Osama O.
Date: 08/16/2024
Analysis Type: Morgenstern-Price

Color	Name	Slope Stability Material Model	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)
	1a. Fill - Undrained	Mohr-Coulomb	120	200	23
	2a. Clay/Silty Clay - Undrained	Mohr-Coulomb	125	200	24
	3. Bedrock	Bedrock (Impenetrable)			



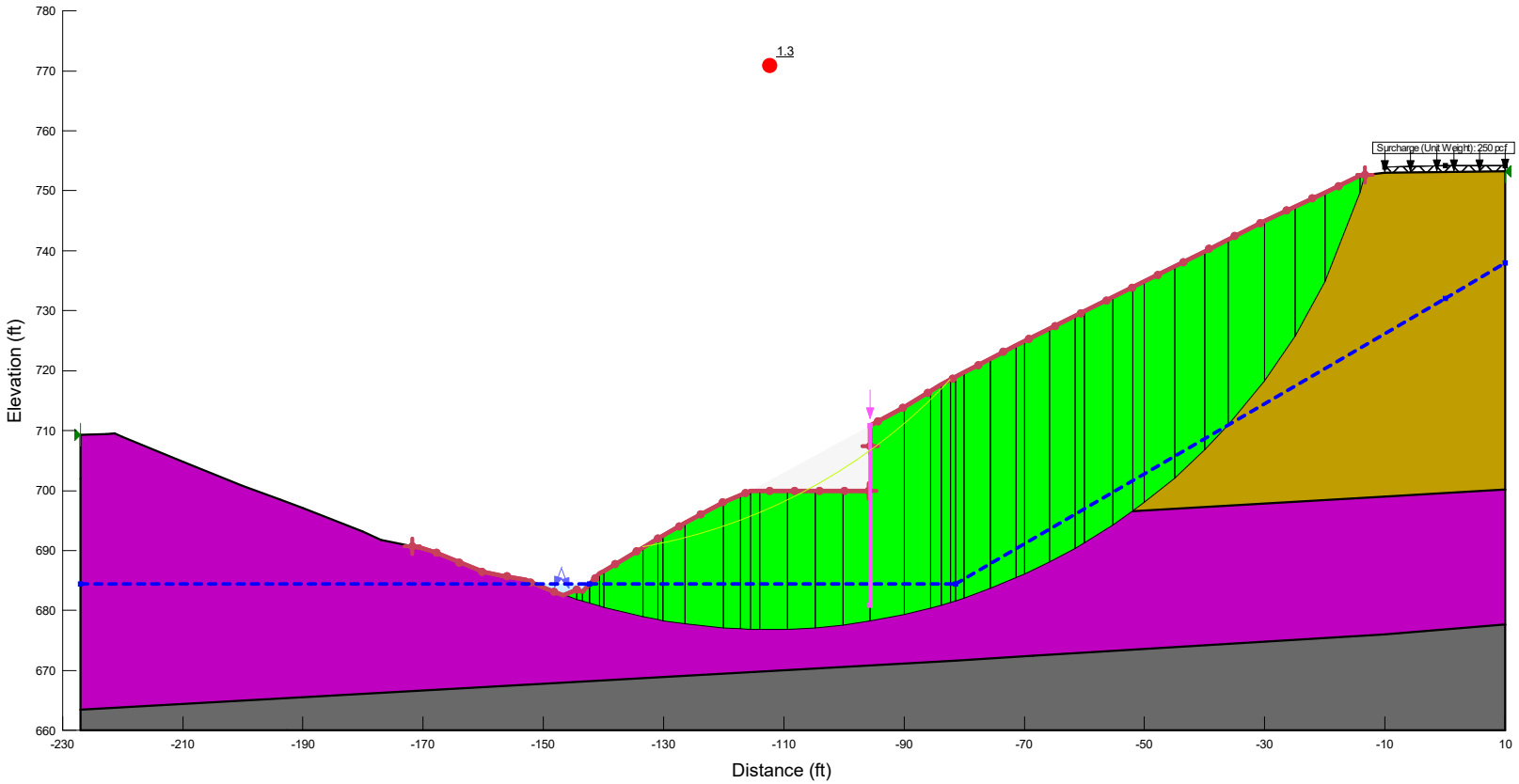
File Name: LAK-90-2.93_Section-2_Sta.31+00_08-06-24.gsz
Name: 1b. Temporary Bench with Sheet Piles
Last Edited By: Saqer, Hamzeh
Created By: El-Quqa, Osama O.
Date: 08/16/2024
Analysis Type: Morgenstern-Price

Color	Name	Slope Stability Material Model	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)
	1a. Fill - Undrained	Mohr-Coulomb	120	200	23
	2a. Clay/Silty Clay - Undrained	Mohr-Coulomb	125	200	24
	3. Bedrock	Bedrock (Impenetrable)			



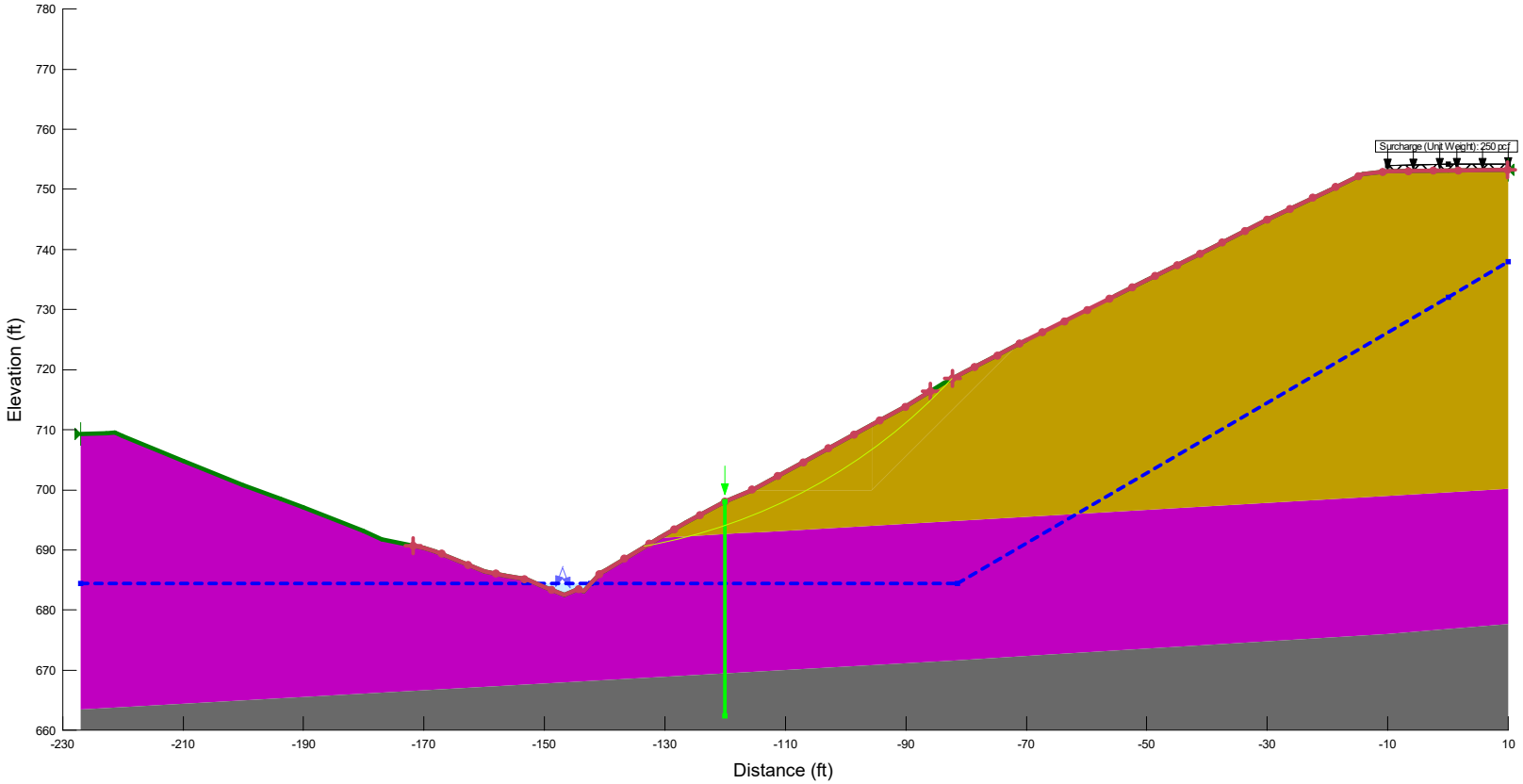
File Name: LAK-90-2.93_Section-2_Sta.31+00_08-06-24.gsz
Name: 1b. Temporary Bench with Sheet Piles
Last Edited By: Saqer, Hamzeh
Created By: El-Quqa, Osama O.
Date: 08/16/2024
Analysis Type: Morgenstern-Price

Color	Name	Slope Stability Material Model	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)
	1a. Fill - Undrained	Mohr-Coulomb	120	200	23
	2a. Clay/Silty Clay - Undrained	Mohr-Coulomb	125	200	24
	3. Bedrock	Bedrock (Impenetrable)			



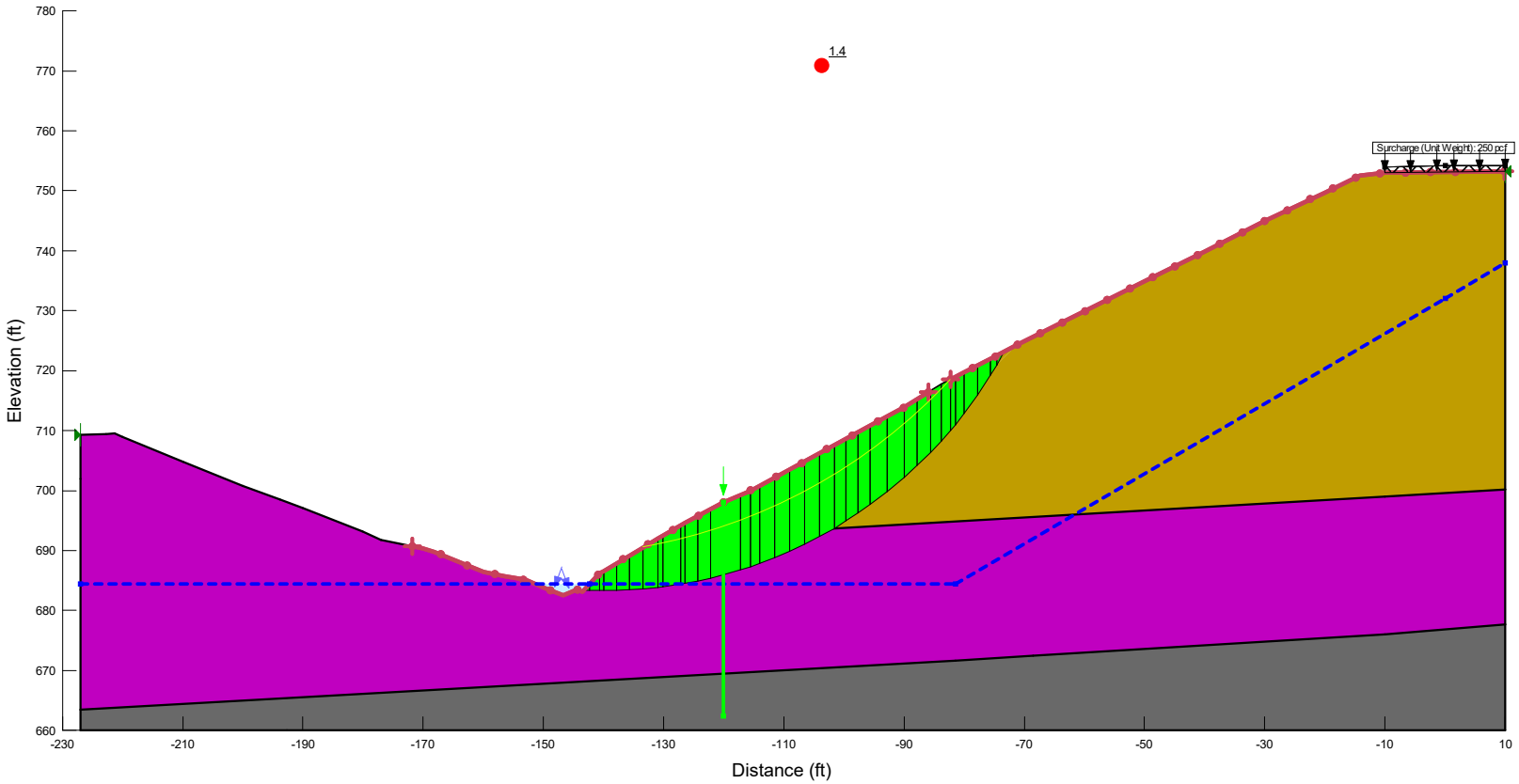
File Name: LAK-90-2.93_Section-2_Sta.31+00_08-06-24.gsz
Name: 2a. Drilled Shafts - Undrained
Last Edited By: Saqer, Hamzeh
Created By: El-Quqa, Osama O.
Date: 08/16/2024
Analysis Type: Morgenstern-Price

Color	Name	Slope Stability Material Model	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)
	1a. Fill - Undrained	Mohr-Coulomb	120	200	23
	2a. Clay/Silty Clay - Undrained	Mohr-Coulomb	125	200	24
	3. Bedrock	Bedrock (Impenetrable)			



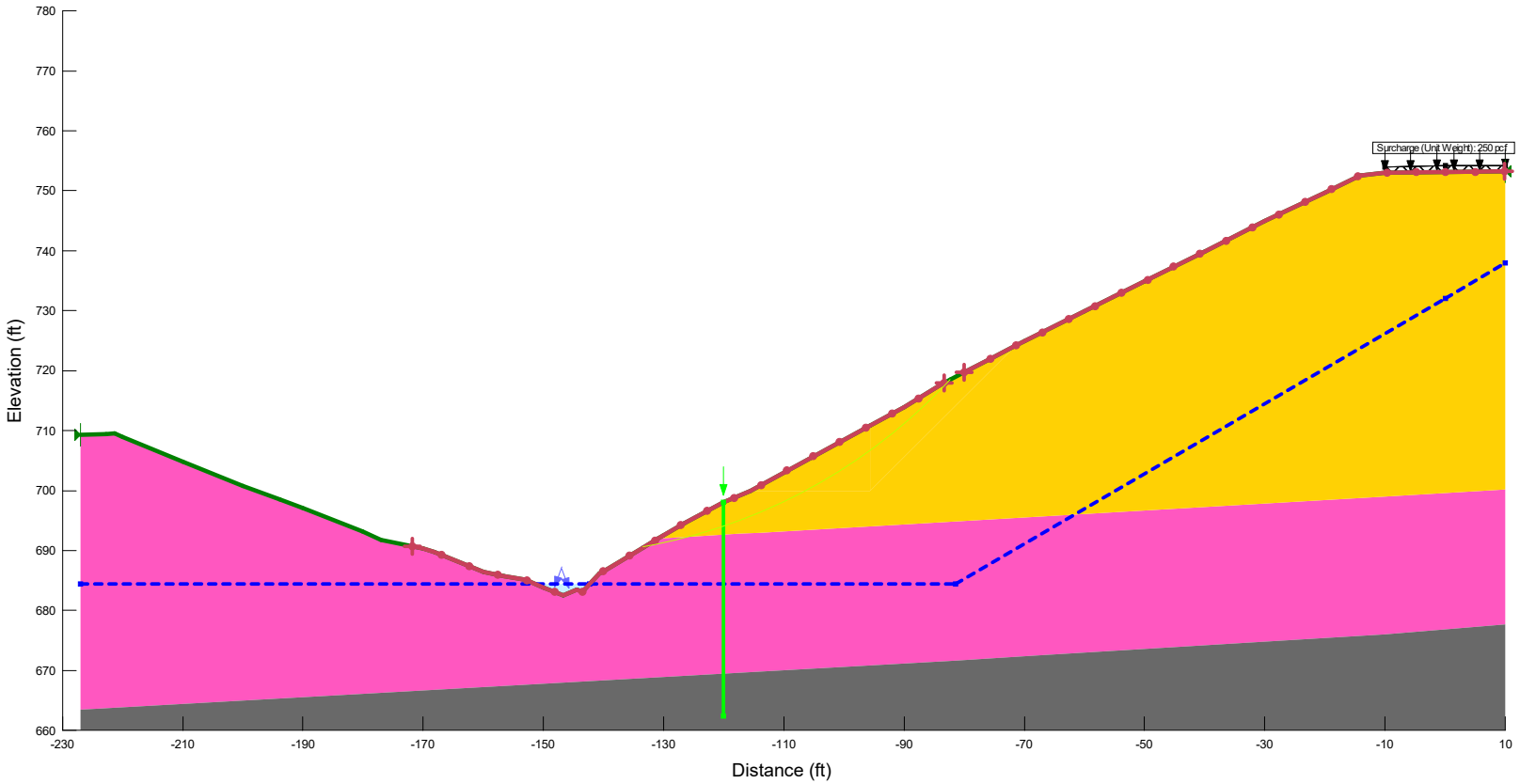
File Name: LAK-90-2.93_Section-2_Sta.31+00_08-06-24.gsz
Name: 2a. Drilled Shafts - Undrained
Last Edited By: Saqer, Hamzeh
Created By: El-Quqa, Osama O.
Date: 08/16/2024
Analysis Type: Morgenstern-Price

Color	Name	Slope Stability Material Model	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)
	1a. Fill - Undrained	Mohr-Coulomb	120	200	23
	2a. Clay/Silty Clay - Undrained	Mohr-Coulomb	125	200	24
	3. Bedrock	Bedrock (Impenetrable)			



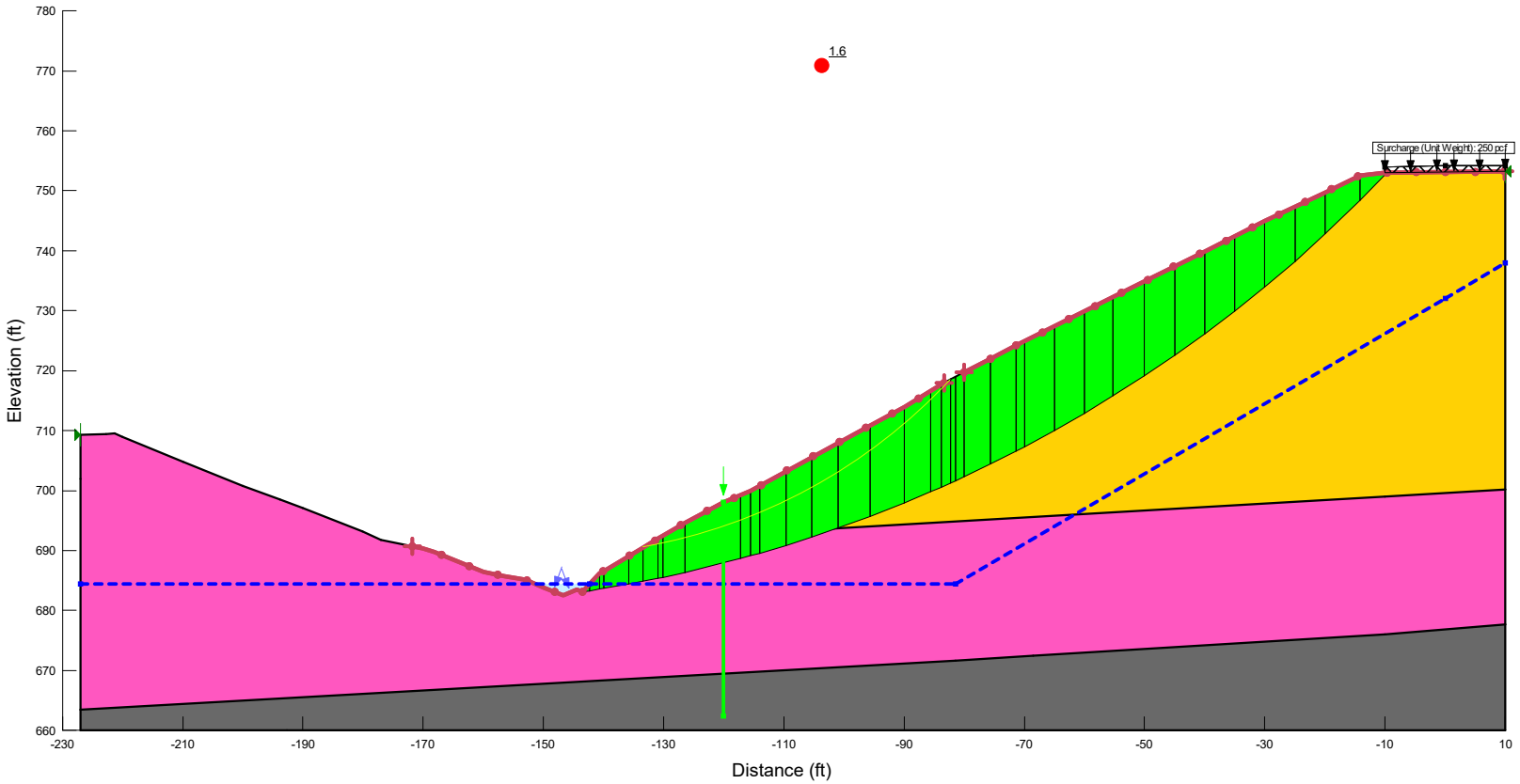
File Name: LAK-90-2.93_Section-2_Sta.31+00_08-06-24.gsz
Name: 2b. Drilled Shafts - Drained
Last Edited By: Saqer, Hamzeh
Created By: El-Quqa, Osama O.
Date: 08/16/2024
Analysis Type: Morgenstern-Price

Color	Name	Slope Stability Material Model	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)
	1b. Fill - Drained	Mohr-Coulomb	120	100	33
	2b. Clay/Silty Clay - Drained	Mohr-Coulomb	125	150	34
	3. Bedrock	Bedrock (Impenetrable)			



File Name: LAK-90-2.93_Section-2_Sta.31+00_08-06-24.gsz
Name: 2b. Drilled Shafts - Drained
Last Edited By: Saqer, Hamzeh
Created By: El-Quqa, Osama O.
Date: 08/16/2024
Analysis Type: Morgenstern-Price

Color	Name	Slope Stability Material Model	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)
	1b. Fill - Drained	Mohr-Coulomb	120	100	33
	2b. Clay/Silty Clay - Drained	Mohr-Coulomb	125	150	34
	3. Bedrock	Bedrock (Impenetrable)			

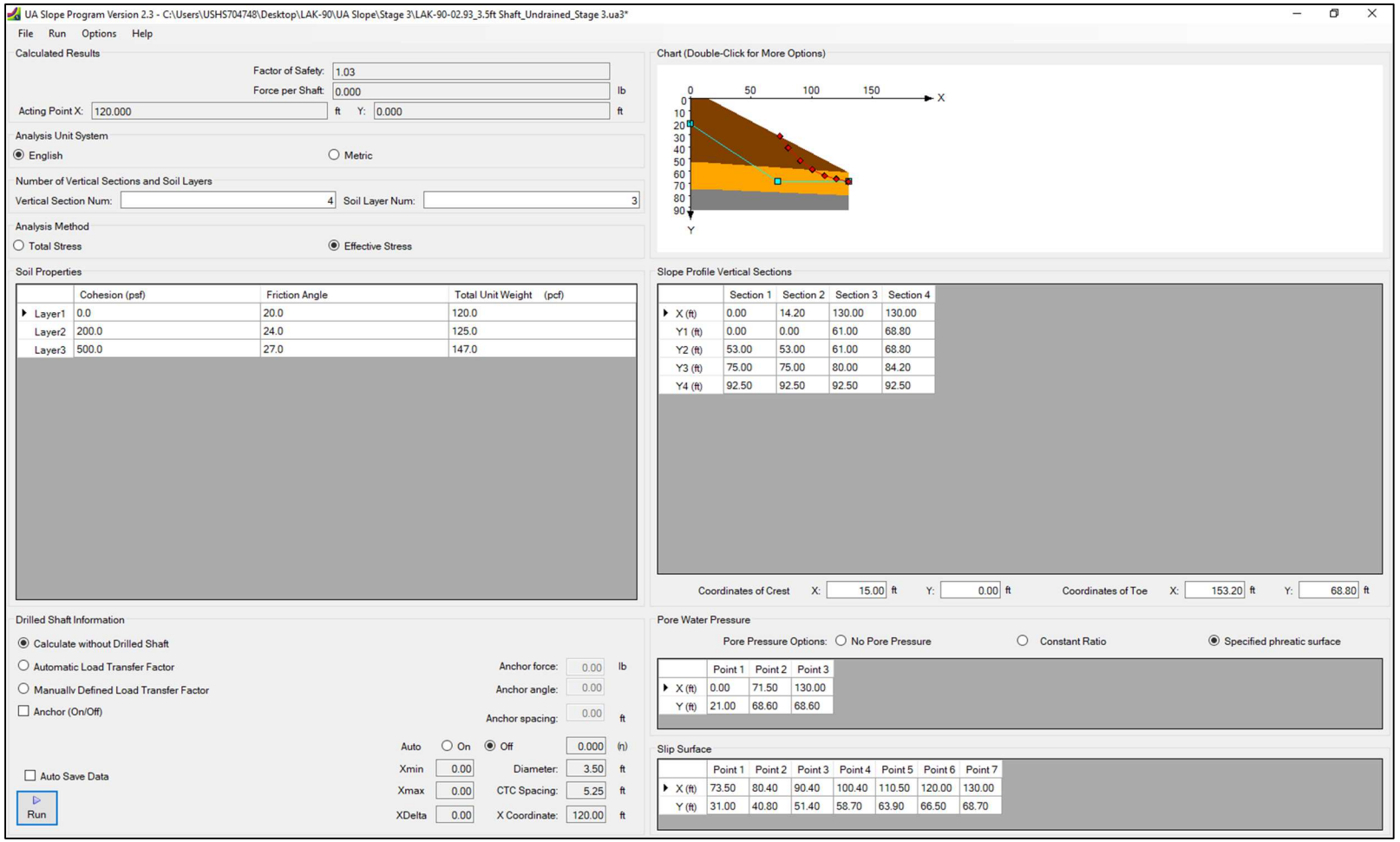


APPENDIX

B-3 DRILLED SHAFT WALL CALCULATIONS

Drilled Shaft Wall Stability Analysis

1. Back calculation of existing slope failure:



	Cohesion (psf)	Friction Angle	Total Unit Weight (pcf)
Layer1	0.0	20.0	120.0
Layer2	200.0	24.0	125.0
Layer3	500.0	27.0	147.0

	Section 1	Section 2	Section 3	Section 4
X (ft)	0.00	14.20	130.00	130.00
Y1 (ft)	0.00	0.00	61.00	68.80
Y2 (ft)	53.00	53.00	61.00	68.80
Y3 (ft)	75.00	75.00	80.00	84.20
Y4 (ft)	92.50	92.50	92.50	92.50

	Point 1	Point 2	Point 3
X (ft)	0.00	71.50	130.00
Y (ft)	21.00	68.60	68.60

	Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7
X (ft)	73.50	80.40	90.40	100.40	110.50	120.00	130.00
Y (ft)	31.00	40.80	51.40	58.70	63.90	66.50	68.70

Figure 1: Back calculation of existing slope failure

2. Stability analysis of slide using 3.5-ft shafts (Undrained):
   - Factor of Safety = 2.85
   - Force per shaft = 99.4 kips

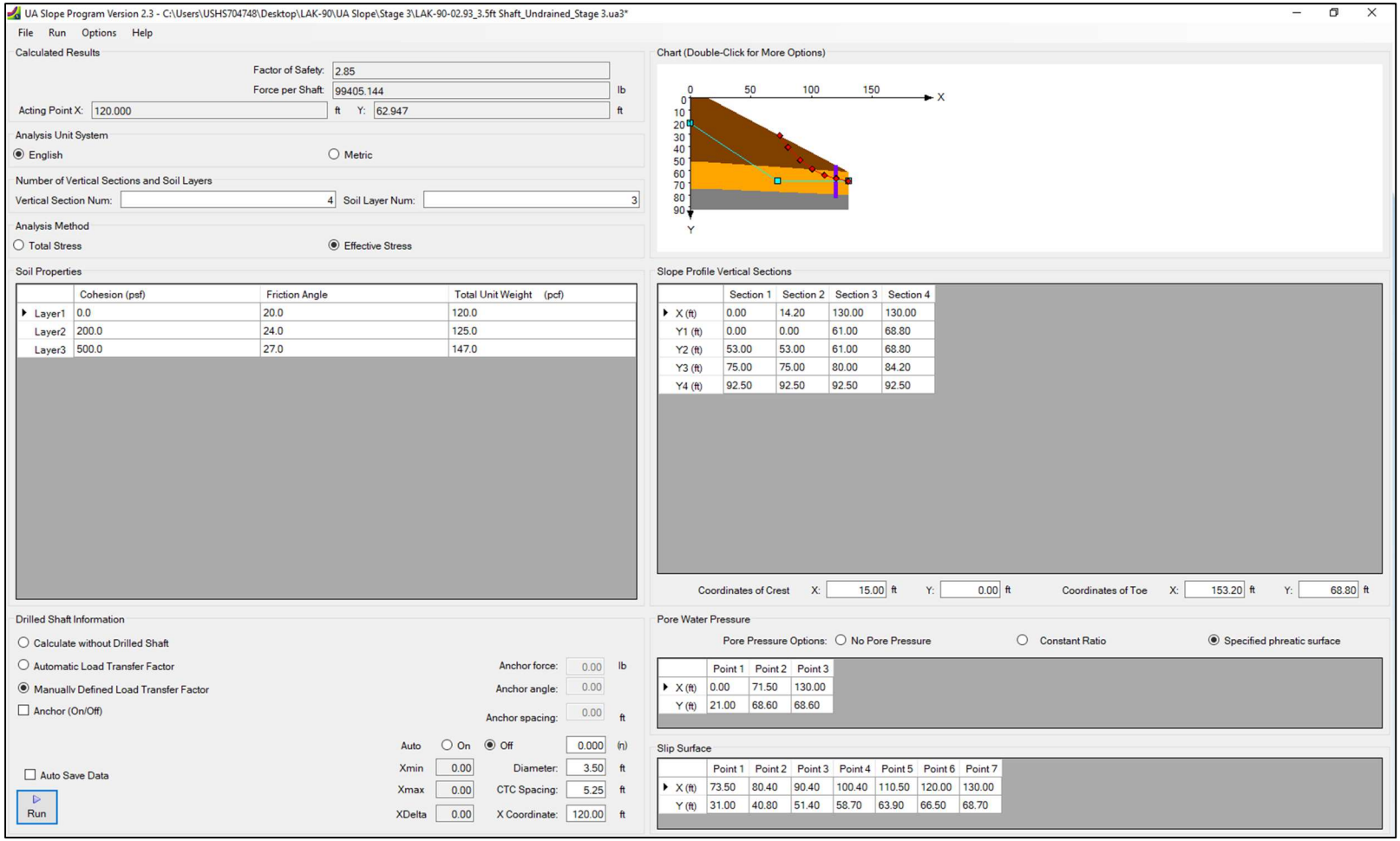


Figure 2: Stability analysis of slide using 3.5-ft shafts (Undrained)

3. Long term global stability analysis (Drained):
    - Factor of Safety = 1.42

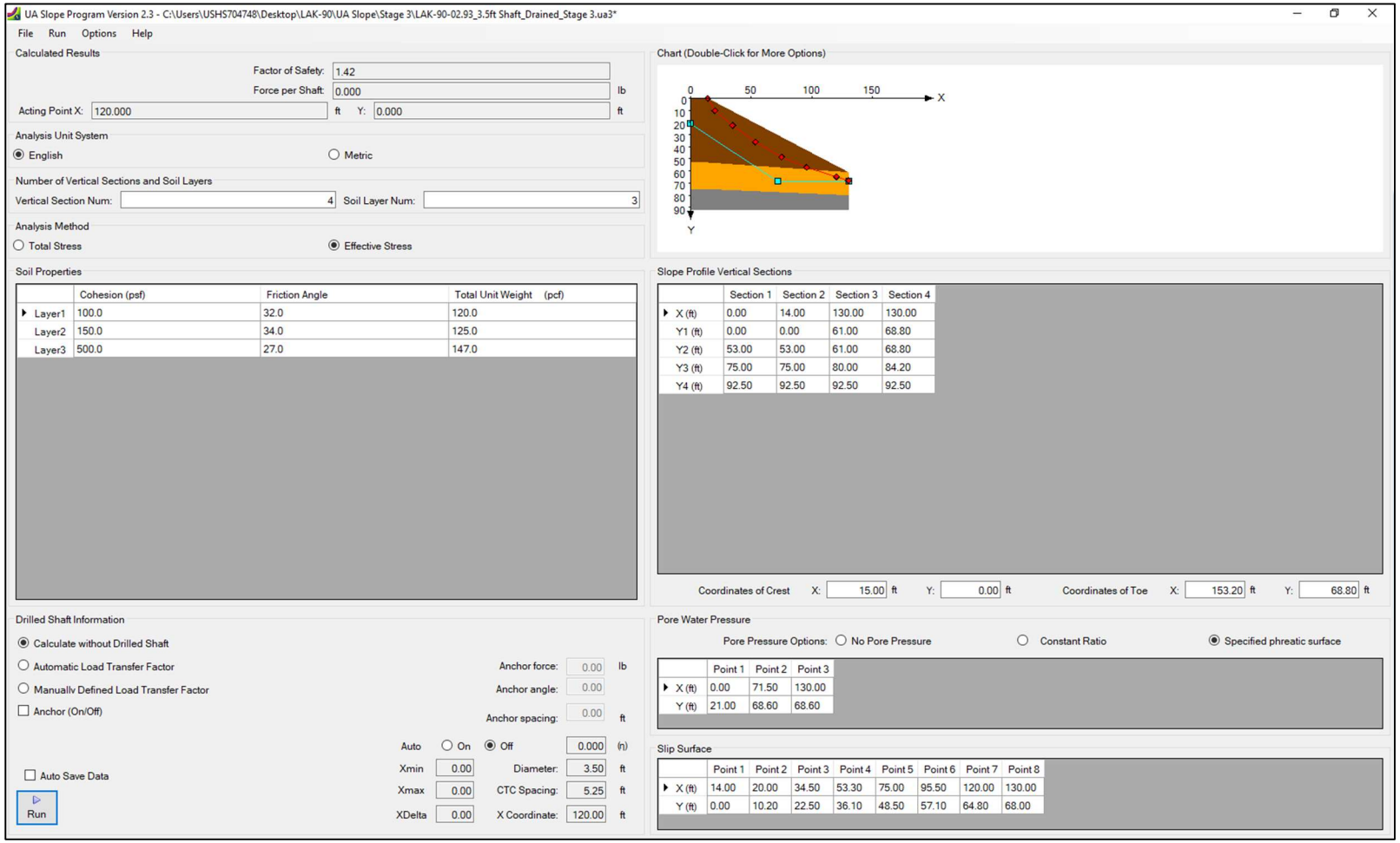
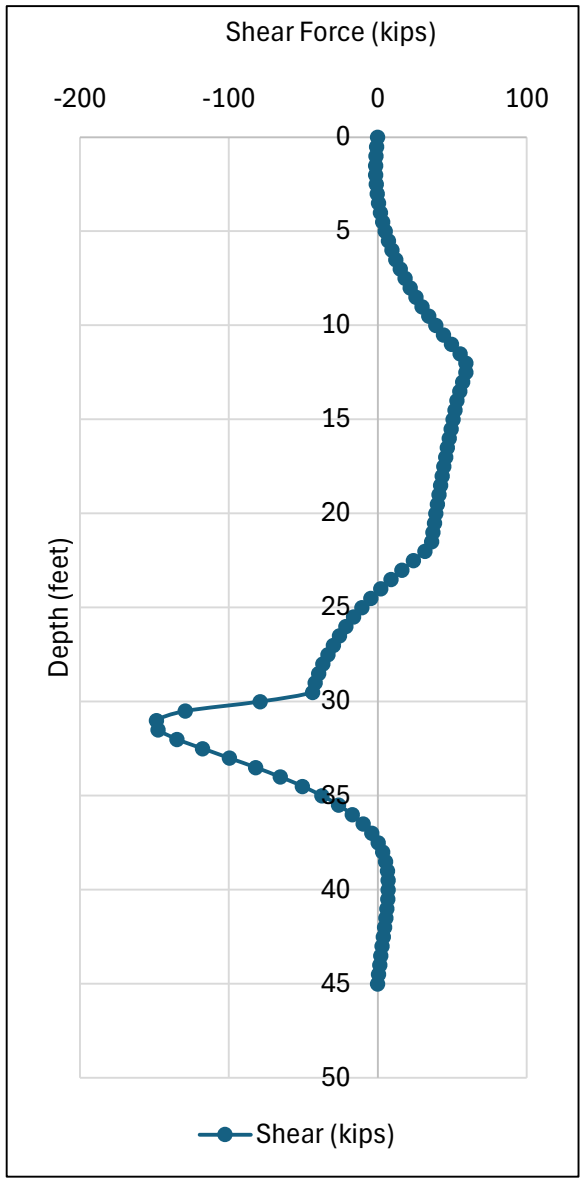
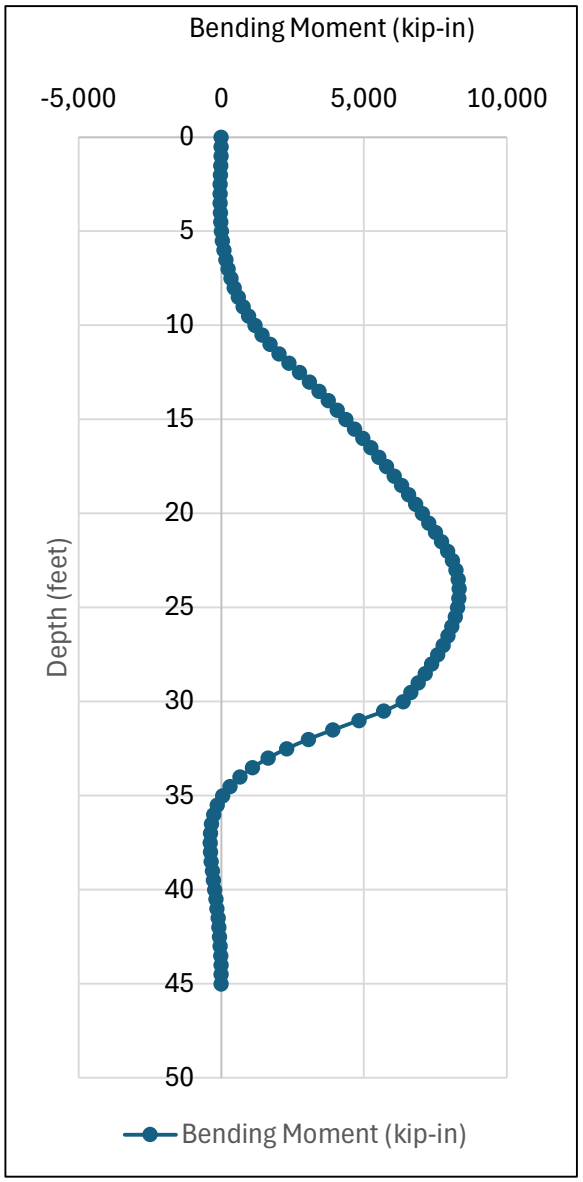
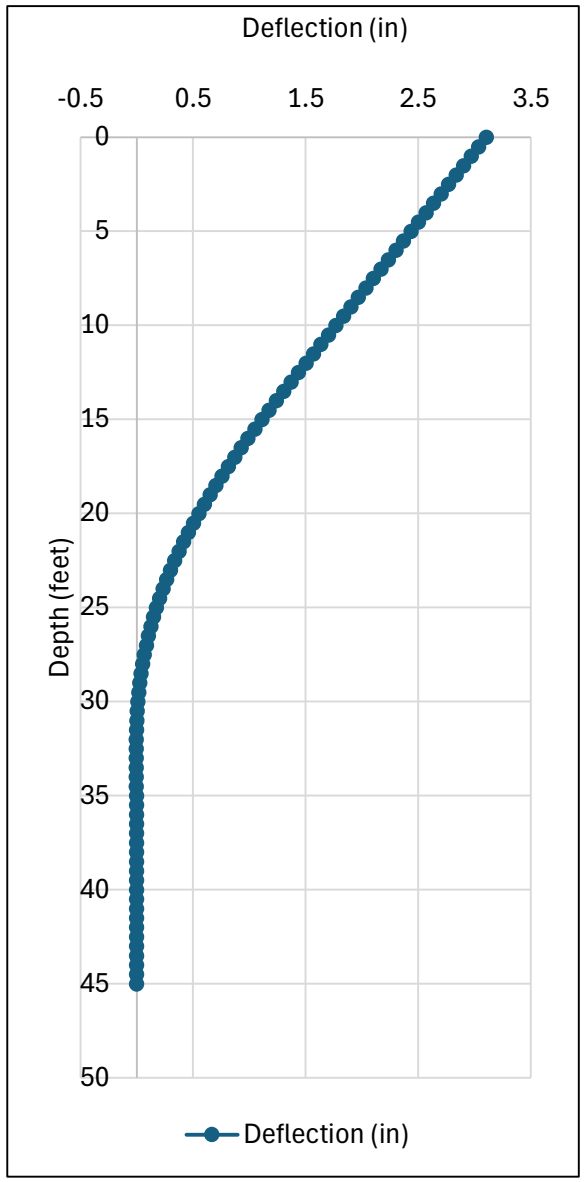


Figure 3: Long term global stability check (Drained condition)

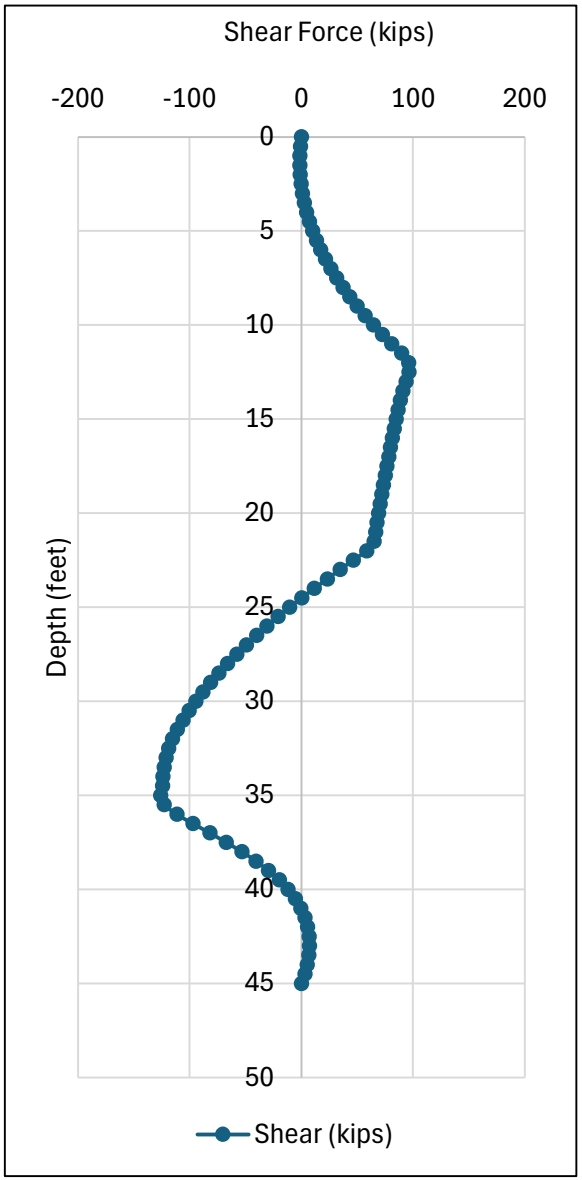
Project:	LAK-90-02.93	Prepared:	HS
Project#	30902165	Date:	10/30/2024
Subject:	Drilled Shaft Analysis at Service Load	Load:	100 kips

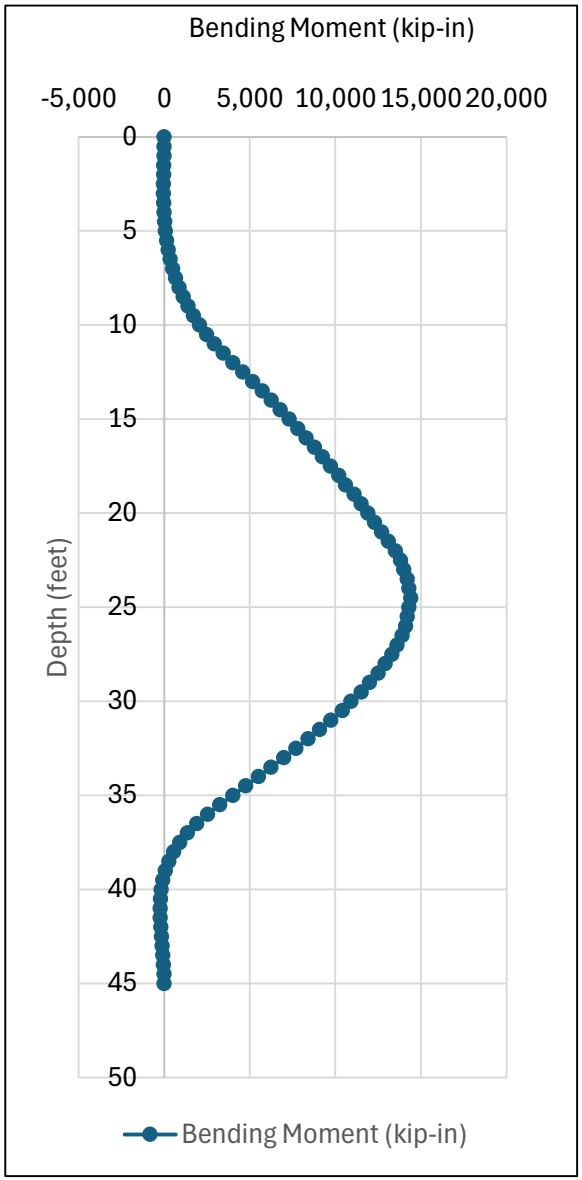






Project:	LAK-90-02.93	Prepared:	HS
Project#	30902165	Date:	10/30/2024
Subject:	Drilled Shaft Analysis at Factored Load	Load:	150 kips





APPENDIX

C HISTORIC RECORDS FROM ODOT TIMS

APPENDIX

C-1 HISTORIC LANDSLIDE RECORDS

November 16, 1961

W. L. Krauser, Engineer of Construction

C. H. Shepard

F. P. Litchiser, Engineer of Tests

Per: N. E. Mason

Project 721-60, CUY-1-15.61, LAK-1-0.00
Lake County Station 102+00 to Station 109+00
Embankment Failure

File: 13-5-1
Cuyahoga-Lake

In accordance with your request, an investigation has been conducted in the area of the subject failure. A report of the findings of the investigation and proposed corrective treatment is hereinafter presented.

FIELD OBSERVATIONS

In the area of the failure the project alignment traverses and generally parallels valley wall of a tributary stream of the Chagrin River. The embankment for the southbound roadway in this area rests on the stream valley slope with the toe of the embankment located on and near the edge of the stream floodplain.

With embankment construction nearly completed to plan section, a crack developed approximately parallel to and near the centerline of the southbound lanes extending from approximately station 103+00 to station 106+00. From station 103+00, backstation the crack extended diagonally across the embankment to the shoulder, diagonally down the slope to the toe, and extending out across natural ground to approximately 265 feet left of station 102+00.

Upstation from station 106+00, the crack extended diagonally forward to the embankment shoulder at approximately station 106+60. The surface of the embankment visually displayed subsidence within the limits defined by the crack and shoulder. As time progressed, the opening of the major crack progressively enlarged with movement most pronounced at the southerly end of the failure area. Additional breakage along the embankment slope was evidenced with elapsed time.

Approximately parallel to the toe of the embankment, and ranging generally from 15 to 30 feet beyond the toe, a roll formed on the natural ground surface, disclosing lateral displacement and heaving of the embankment foundation beyond the toe. The roll was evidenced from approximately station 102+25 to station 107+25. Although no major movement had occurred, distress in the foundation was evidenced by tension cracks forward to station 108+50±.

SUBSURFACE INVESTIGATION

October 17-18, 1961, additional test borings were drilled within the failure area for developing in detail subsurface conditions associated with the failure. Both drive sample-core borings and bit-on-kelly soil auger borings were drilled. A limited number of drive sample-rock core borings were drilled into underlying bedrock; these borings were supplemented by a number of soil auger borings, a number of which also penetrated into shale bedrock.

The test borings disclose that natural soil cover over rock in place ranges from approximately five (5) to 15 feet in thickness. Surface of bedrock slopes downward from right to left beneath the embankment. Fill on the valley floor is the order of nine (9) to 15 feet in thickness. Bedrock is shale.

For more detailed study of the findings, you are referred to the attached drawings and tabulated data which presents test boring locations, graphical logs of borings with respect to cross sections, and physical characteristics of soil types encountered.

ANALYSIS OF FINDINGS

Failure of the embankment is attributed to overstressing of the soils forming the natural cover over a sloping surface of shale bedrock and comprising the embankment foundation. Failure of the foundation is considered to extend to the bedrock surface. The failure is considered of a rotational nature - subsidence at the roadway level, rotational movement of the embankment and foundation mass, with heaving in the immediate vicinity of the toe of the embankment.

PROPOSED TREATMENT

It is considered that most applicable treatment for stabilizing the embankment is the construction of a berm at the toe of the embankment. It is proposed that berm treatment extend from approximately station 102+00 to station 109+00. The required dimensions of the berm are approximately; 20 feet in height, 40 feet in width from outer shoulder point of berm to plan toe of embankment, and side slope of berm of 2 horizontal run to 1 vertical rise. Details by station of berm features are presented as follows:

STATION	BERM DIMENSIONS BERM SHOULDER POINT ELEV.	DIST. LEFT C.L.	BERM TOE DIST. LEFT C.L.
102+00		No Treatment	
103+00	725.0'	290'	330'
104+00	722.0'	320'	360'
105+00	717.0'	326'	366'
106+00	712.0'	337'	377'
107+00	710.0'	338'	378'
108+00	710.0'	338'	378'
109+00		No Treatment	

Between station 102+00 and station 103+00, hold the shoulder point at elevation 725.0' and the distance from centerline constant at 290 feet, thereby feathering the berm into the natural terrain.

Between station 108+00 and station 109+00, construct a transitional section, uniformly tapering from a full berm section to no treatment.

Construction of the berm will necessitate relocation of the present stream channel.

Channel relocation and berm construction will entail procurement of additional right-of-way.

At station 109+00, movement of the embankment foundation has caused upward deflection of a 27-inch pipe from the outlet end to the bend at the bottom of the embankment. Correction of this condition and extension of the pipe beneath the berm are required.

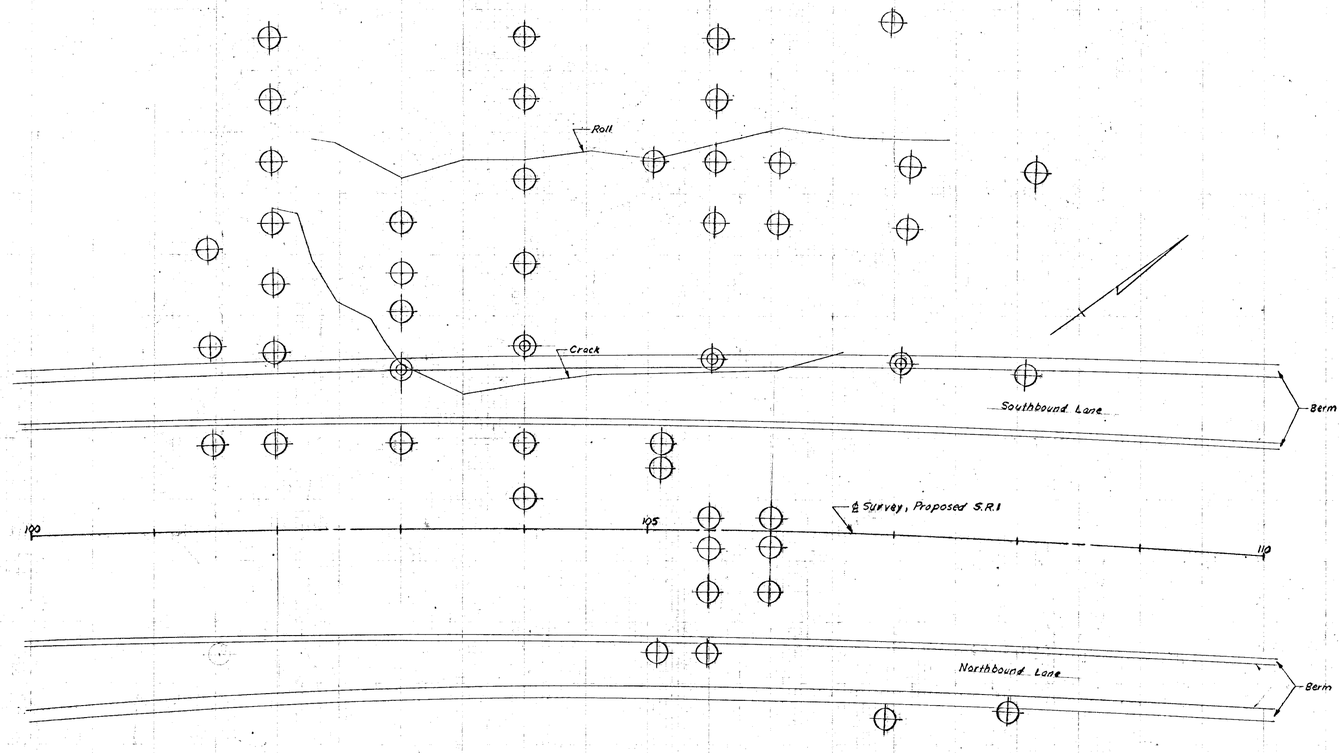
R. E. Litchiser
Engineer of Tests

Per: _____
M. E. Mason
Assistant Engineer

MEM:pjs
Attach.
cc: W. J. Cremeen, Attn: H. F. Marshall
A. G. Donovan, Attn: M. D. Busciglio
M. E. Mason (3)

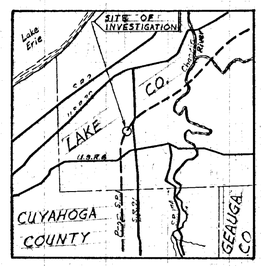
EMB. FAILURE INVESTIGATION
CUYAHOGA - LAKE COS.
CUY-1-15.91
LAK-1-0.00
OHIO STATE HIGHWAY
TESTING LABORATORY
COLUMBUS, OHIO

1/6



Boring Plan
Scale 1"=50'

Scale: 2"=100'



Location map

Drilling - Auger - J.R.G, B.D.L - 10/17/61 - 10/18/61
Core - D.W.B, J.R.V - 10/17/61 - 10/18/61
Drafting - R.C.B, D.M, A.C.S, P.O.G. - 11/16/61

LEGEND FOR PROJECT

DESCRIPTION	OHIO CLASS
Gravel	A-1-a
Gravel and stone fragments with sand	A-1-b
Coarse and fine sand	A-3a
Gravel and stone fragments with sand & silt	A-2-4
Sandy silt	A-4a
Silt	A-4b
Silt and clay	A-6a
Clay	A-7-6
Rock-soil mixture	Visual
Weathered Shale	Visual
Shale	Visual
Various other materials	Visual

Topsoil = X = Approximate depth
Auger boring - plan view
Drive sample and core boring - plan view
Auger boring plotted to vertical scale only
Drive sample and core boring plotted to vertical scale only
Number of blows for "Standard Penetration" test
X= number of blows for the first 6 inches
Y= number of blows for second 6 inches
Water content nearly equal to or greater than liquid limit
Indicates a non-plastic material with high water content
W — Free water
▼ Static water level
B Indicates broken rock interval
NOTE: Figures beside borings indicates water content in percent e.g. 15

EMB. FAILURE INVESTIGATION
CUYAHOGA - LAKE COS.
CUY-1-15.91
LAK-1-0.00

OHIO STATE HIGHWAY TESTING LABORATORY
COLUMBUS, OHIO

2/6

SUMMARY OF SOIL TEST DATA

NOTE: NP shown in Liquid Limit and Plasticity Index columns indicates that the material is non-plastic.

Station	Offset	Depth From-To	% Agg.	% C.S.	% F.S.	% Silt	% Clay	L.L.	P.I.	% W.C.	SHTL Class.
101+50	230'Lt	0.0-3.5	22	10	11	30	27	37	7	17	A-4a
		3.5-5.0	Light Brown Weathered Shale							10	Visual
		5.0-8.0	Light Brown Weathered Shale							7	Visual
		8.0-12.0	Gray Weathered Shale							14	Visual
101+50	150'Lt	0.0-3.5	15	6	4	44	31	27	11	10	A-6a
		3.5-6.0	38	16	8	13	25	27	7	9	A-4a
		6.0-9.0	Gray Weathered Shale							6	Visual
		9.0-11.0	Brown Weathered Shale							11	Visual
		11.0-13.0	Gray Weathered Shale							7	Visual
101+50	70'Lt	0.0-2.0	23	4	6	40	27	31	11	11	A-6a
		2.0-6.5	Brown Weathered Shale							9	Visual
		6.5-8.5	Gray Weathered Shale							8	Visual
102+00	400'Lt	0.3-4.0	0	3	5	48	44	37	11	25	A-6a
		4.0-9.0	0	3	4	40	53	37	14	32	A-6a
		9.0-16.0	0	1	0	67	32	NP	NP	32	A-4b
		16.0-20.0	24	3	1	36	36	33	11	15	A-6a
		20.0-22.0	Gray Broken Shale							12	Visual
102+00	350'Lt	0.3-4.0	15	8	6	40	31	32	11	13	A-6a
		4.0-10.0	8	4	6	44	38	32	12	15	A-6a
		10.0-13.0	2	3	4	50	41	29	6	20	A-4b
		13.0-15.0	Gray Broken Shale							8	Visual
102+00	300'Lt	0.3-4.0	14	8	6	32	40	33	11	12	A-6a
		4.0-7.0	10	14	7	27	42	33	13	17	A-6a
		7.0-12.0	Brown Weathered Shale							9	Visual
		12.0-16.0	Gray Weathered Shale							7	Visual
		16.0-18.0	Gray Weathered Shale							15	Visual
		18.0-20.0	Gray Broken Shale							7	Visual
102+00	250'Lt	0.2-3.0	25	3	2	34	36	36	11	14	A-6a
		3.0-10.0	51	3	2	24	20	33	11	9	A-6a
		10.0-13.0	Gray Broken Shale							6	Visual
102+00	200'Lt	0.0-5.0	Brown Sandy Silty Clay & Soft Shale Fragments							10	Visual
		5.0-7.0	Gray Broken Shale							5	Visual
102+00	145'Lt	0.0-5.5	Gray Silty Clay and Shale fragments							8	Visual
		5.5-11.0	29	5	3	23	40	34	11	8	A-6a
		11.0-13.5	16	8	7	38	31	32	11	10	A-6a
		13.5-15.0	Gray Weathered Shale							4	Visual
102+00	70'Lt	0.0-4.0	Brown Silty Clay and Shale fragments							7	Visual
		4.0-6.0	Brown Silty Clay and Shale fragments							11	Visual
		6.0-7.0	23	3	2	33	39	32	11	12	A-6a
		7.0-11.0	Brown Weathered Shale							8	Visual
103+00	250'Lt	0.0-7.0	Rock Soil Mixture							15	Visual
		7.0-11.0	Rock Soil Mixture							4	Visual
		11.0-16.0	45	3	2	26	24	37	13	11	A-6a
		16.0-19.0	4	4	4	42	46	31	11	16	A-6a
		19.0-26.0	14	2	4	46	34	35	13	16	A-6a
		26.0-28.0	Gray Broken Shale							8	Visual
103+00	208'Lt	0.0-5.0	22	10	10	36	22	28	7	13	A-4a
		5.0-10.0	5	5	9	43	38	29	11	13	A-6a
		10.0-15.0	9	8	7	38	38	31	11	16	A-6a
		15.0-19.0	7	7	5	55	26	34	8	22	A-4b
		19.0-26.0	8	3	4	37	48	32	11	16	A-6a
		26.0-32.0	Brown Weathered Shale							11	Visual
103+00	177'Lt	0.0-6.0	22	7	6	49	16	31	8	11	A-4a
		6.0-12.0	16	5	6	39	34	30	11	13	A-6a
		12.0-17.0	7	7	10	47	29	29	13	17	A-6a
		17.0-21.0	4	6	8	45	37	27	11	11	A-6a
		21.0-26.0	7	8	4	43	38	34	11	20	A-6a
		26.0-30.0	Brown Weathered Shale							11	Visual
103+00	70'Lt	0.0-5.0	Rock Soil Mixture							8	Visual
		5.0-8.0	Rock Soil Mixture							10	Visual
		8.0-12.0	6	3	7	44	40	39	11	13	A-6a
		12.0-16.5	22	4	2	32	40	37	11	13	A-6a
		16.5-20.0	Gray Broken Shale							7	Visual
104+00	400'Lt	0.3-4.0	36	11	6	21	26	32	7	9	A-4a
		4.0-8.0	0	0	1	42	47	38	13	27	A-6a
		8.0-15.0	0	0	0	57	43	NP	NP	31	A-4b
		15.0-20.0	5	7	3	51	34	26	4	31	A-4b
		20.0-23.0	31	41	14	- 14 -		NP	NP	14	A-1-b
		23.0-27.0	36	15	5	24	20	29	10	13	A-4a
104+00	350'Lt	0.3-4.0	0	3	6	41	50	33	11	15	A-6a
		4.0-11.0	0	1	1	39	59	36	12	26	A-6a
		11.0-17.0	0	0	0	52	48	28	4	37	A-4b
		17.0-21.0	9	38	21	18	14	19	3	16	A-3a
		21.0-23.0	24	5	6	37	28	26	11	13	A-6a
104+00	285'Lt	0.0-4.0	36	15	7	22	21	31	4	18	A-4a
		4.0-8.0	7	8	21	41	23	NP	NP	20	A-4a
		8.0-12.0	4	2	2	42	50	37	11	18	A-6a
104+00	216'Lt	0.0-5.0	5	6	11	38	40	30	11	14	A-6a
		5.0-10.0	4	6	10	38	42	30	11	13	A-6a
		10.0-15.0	5	8	9	39	39	29	11	14	A-6a
		15.0-20.0	6	9	11	40	34	29	11	15	A-6a
		20.0-27.0	12	8	7	36	37	29	11	16	A-6a
		27.0-32.0	11	6	5	39	39	34	11	22	A-6a
104+00	70'Lt	0.0-2.0	Rock Soil Mixture							6	Visual
		2.0-6.5	Rock Soil Mixture							9	Visual
		6.5-8.5	Rock Soil Mixture							11	Visual
		8.5-13.0	Rock Soil Mixture							9	Visual
		13.0-17.0	24	6	7	34	29	28	7	12	A-4a
		17.0-22.0	15	4	5	36	40	36	12	16	A-6a
		22.0-27.0	4	4	6	48	48	33	11	15	A-6a
		27.0-32.0	6	7	10	37	40	29	11	15	A-6a
104+00	25'Lt	0.0-5.0	Rock Soil Mixture							10	Visual
		5.0-7.5	26	5	4	33	32	36	11	17	A-6a
		7.5-12.0	16	8	6	40	30	39	12	21	A-6a
		12.0-15.5	32	4	3	30	31	36	11	13	A-6a
		15.5-17.5	Brown Silty Clay & Shale Fragments							8	Visual
		17.5-19.5	Gray Broken Shale							8	Visual
105+00	300'Lt	0.0-7.0	16	15	12	31	26	28	5	13	A-4a
		7.0-10.0	0	2	8	66	44	NP	NP	25	A-4b
		10.0-13.0	5	20	42	21	12	NP	NP	13	A-3a
		13.0-17.0	Gray Broken Shale							10	Visual
105+10	70'Lt	0.0-5.0	Rock Soil Mixture							11	Visual
		5.0-10.0	Rock Soil Mixture							9	Visual
		10.0-11.5	Rock Soil Mixture							13	Visual
		11.5-16.0	6	5	6	34	49	34	11	15	A-6a
		16.0-21.0	9	4	7	37	43	38	11	19	A-6a
		21.0-26.0	11	5	9	34	41	34	11	17	A-6a
		26.0-30.0	5	6	7	41	41	33	11	16	A-6a
		30.0-32.0	28	5	8	30	29	31	11	12	A-6a
105+10	50'Lt	0.0-5.5	Rock Soil Mixture							8	Visual
		5.5-11.0	10	4	5	37	44	35	11	15	A-6a
		11.0-16.0	16	6	9	36	33	34	11	16	A-6a
		16.0-21.0	9	5	4	35	47	32	11	14	A-6a
		21.0-26.0	18	8	9	26	39	30	11	19	A-6a
		26.0-32.0	7	5	9	37	42	31	11	14	A-6a
105+10	100'Rt	0.0-6.0	Gray Weathered Shale							8	Visual
105+50 (105+50)	400'Lt	0.0-5.0	18	13	9	35	26	31	9	17	A-4a
		5.0-8.0	0	2	10	45	43	29	11	36	A-6a
		8.0-15.0	17	53	22	- 8 -		NP	NP	17	A-1-b
		15.0-21.0	31	47	17	- 5 -		NP	NP	17	A-1-b
		21.0-23.0	36	18	6	20	20	26	2	13	A-4a
105+50 (105+50)	350'Lt	0.3-5.0	6	3	3	47	41	31	11	14	A-6a
		5.0-10.0	0	1	0	55	44	30	6	34	A-4b
		10.0-12.0	45	27	8	11	9	NP	NP	10	A-1-b
		12.0-15.0	29	13	10	28	20	26	4	22	A-4a
		15.0-17.0	38	14	6	25	17	28	6	15	A-4a
105+60	300'Lt	0.0-4.0	0	1	1	53	45	36	8	28	A-4b
		4.0-10.0	0	1	2	47	50	32	11	33	A-6a
		10.0-16.0	0	1	2	56	41	NP	NP	30	A-4b
		16.0-17.0	12	9	11	45	23	26	6	12	A-4a
105+60	250'Lt	0.0-5.0	4	5	8	38	45	30	11	17	A-6a
		5.0-10.0	4	4	8	34	50	31	11	17	A-6a
		10.0-15.0	6	9	11	33	41	27	11	16	A-6a
		15.0-20.0	12	7	8	39	34	31	11	14	A-6a
		20.0-23.0	7	8	11	37	37	27	7	17	A-4a
		23.0-29.0	13	8	6	37	36	36	14	18	A-6a
		29.0-32.0	Gray Broken Shale							8	Visual
105+60	10'Lt	0.0-4.0	23	4	3	32	38	34	14	11	A-6a
		4.0-9.0	21	9	9	26	35	36	14	13	A-6a
		9.0-14.0	5	5	7	31	52	36	13	16	A-6a
		14.0-19.0	5	6	9	39	41	30	11	15	A-6a
		19.0-20.5	5	6	9	37	43	30	11	16	A-6a
		20.5-23.0	14	7	8	33	38	32	11	14	A-6a
		23.0-26.5	3	3	4	45	45	42	13	23	A-7-6
		26.5-31.0	Brown Weathered Shale							11	Visual
105+50	15'Rt	0.0-4.0	14	5	5	36	40	31	11	9	A-6a
		4.0-9.0	9	5	7	35	44	34	11	16	A-6a
		9.0-12.0	23	5	6	33	33	30	11	12	A-6a
		12.0-16.0	11	7	6	39	37	39	15	17	A-6a
		16.0-20.0	15	9	7	35	34	31	11	13	A-6a
		20.0-25.0	Brown Weathered Shale							10	Visual
105+50	50'Rt	0.0-2.0	54	5	6	19	16	31	6	10	A-2-4
		2.0-7.0	15	4	3	30	48	48	17	19	A-7-6
		7.0-10.0	20	6	3	39	32	34	11	13	A-6a
		10.0-13.0	Brown Weathered Shale							10	Visual
105+50	100'Rt	0.0-2.5	27	3	4	31	35	38	11	11	A-6a
		2.5-7.0	Gray Weathered Shale							5	Visual
		7.0-11.0	Gray Weathered Shale							4	Visual
106+00	300'Lt	0.0-6.0	10	28	12	31	19	33	8	18	A-4a
		6.0-8.0	47	15	7	17	14	28	4	15	A-2-4
		8.0-14.0	45	30	9	8	8	22	5	15	A-1-b
		14.0-16.0	31	3	6	40	20	27	4	10	A-4a
106+00	250'Lt	0.0-5.0	7	6	9	42	36	36	14	14	A-6a
		5.0-10.0	5	7	10	38	40	29	11	14	A-6a
		10.0-15.0	8	10	12	38	32	26	6	16	A-4a
		15.0-20.0	14	6	11	31	38	35	15	15	A-6a
		20.0-27.0	11	10	8	32	39	37	11	24	A-6a
		27.0-30.0	0	0	2	76	22	NP	NP	26	A-4b
		30.0-32.0	Gray Silty Clay & Soft Shale Fragments							10	Visual
106+00	10'Lt	0.0-5.0	11	8	6	31	44	37	11	15	A-6a
		5.0-10.0	7	3	7	38	45	31	11	15	A-6a
		10.0-15.0	8	5	8	41	38	36	13	16	A-6a
		15.0-20.0	6	6	8	41	39	32	11	15	A-6a
		20.0-21.0	13	6	5	42	34	34	11	15	A-6a
		21.0-26.0	5	6	7	38	44	32	11	16	A-6a
		26.0-28.0	5	5	10	40	40	34	11	17	A-6a
		28.0-30.0	17	7	6	37	33	41	14	17	A-7-6
		30.0-32.0	6	4	4	42	44	37	11	24	A-6a
106+00	13'Rt	0.0-5.0	8	2	5	37	48	38	14	16	A-6a
		5.0-10.0	13	8	9	40	30	29	11	15	A-6a
		10.0-15.0	6	5	8	47	34	31	11	14	A-6a
		15.0-17.5	3	7	11	43	36	27	6	15	A-4a
		17.5-21.0	20	9	8	34	29	31	11	14	A-6a
		21.0-24.0	6	3	3	40	48	40	12	19	A-6a
		24.0-28.0	17	6	4	31	42	36	11	13	A-6a
		28.0-31.0	21	5	5	34	35	35	11	16	A-6a
		31.0-32.0	33	5	6	28	28	33	11	15	A-6a
106+00	50'Rt	0.0-1.5	19	4 (3)	3	50	24	32	4	13	A-4b
		1.5-5.0	2	3	17	37	41	29	11	18	A-6a
		5.0-7.0	21	5	5	43	26	33	11	12	A-6a
		7.0-12.0	13	7	6	40	34	30	11	13	A-6a
		12.0-17.0	2	4	2	51	41	41	15	17	A-7-6
		17.0-22.0	17	6	3	41	33	36	11	13	A-6a
		22.0-26.0	Brown Weathered Shale							10	Visual
106+00	416'Lt	0.0-6.0	16	15	12	29	28	31	7	27	A-4a
		6.0-10.0	0	0	0	57	43	33	5	39	A-4b
		10.0-16.0	47	40	9	- 4 -		NP	NP	16	A-1-b
		16.0-22.0	67	23	4	- 6 -		NP	NP	10	A-1-b
		22.0-24.0	25	8	7	30	30	27	11	10	A-6a
107+00	300'Lt	0.0-4.0	2	14	6	47	31	34	5	29	A-4a
		4.0-6.0	0	1	5	70	24	NP	NP	30	A-4b
		6.0-12.0	44	42	8	- 6 -		NP	NP	17	A-1-b
		12.0-17.0	40	50	7	- 3 -		NP	NP	14	A-1-b
107+00	250'Lt	0.0-3.0	Rock Soil Mixture							9	Visual
		3.0-10.0	4	4	6	38	48	29	11	17	A-6a
		10.0-13.0	9	5	10	38	38	28	11	12	A-6a
		13.0-20.0	11	6	10	38	35	30	11	15	A-6a
107+00	150'Rt	0.0-5.0	Rock Soil Mixture							7	Visual
		5.0-8.0	Rock Soil Mixture							5	Visual
		8.0-12.0	Rock Soil Mixture							15	Visual
		12.0-15.0	Rock Soil Mixture							14	Visual
		15.0-16.0	Rock Soil Mixture							10	Visual
108+00	300'Lt	0.0-5.0	28	12	10	32	18	NP	NP	19	A-4a
		5.0-7.0	60	3	6	19	12	33	9	16	A-2-4
		7.0-14.0	58	30	6	- 9 -		NP	NP	12	A-1-a
		14.0-16.0	39	8	4	28	21	28	9	15	A-4a
108+00	135'Lt	0.0-5.0	Rock Soil Mixture							8	Visual
		5.0-9.5	Rock Soil Mixture							7	Visual
		9.5-11.5	0	3	7	54	36	37	13	17	A-6a
		11.5-16.0	8	2	6	42	42	28	11	16	A-6a
		16.0-21.0	7	3	4	45	41	24	11	14	A-6a
		21.0-26.0	16	9	6	34	35	32	11	13	A-6a
		26.0-30.0	6	5	9	44	36	34	12	17	A-6a
108+00	140'Rt	0.0-2.5	Rock Soil Mixture							8	Visual
		2.5-8.0	Rock Soil Mixture							12	Visual
		8.0-13.0	Rock Soil Mixture							15	Visual
		13.0-15.0	Rock Soil Mixture							8 (22)	Visual
		15.0-20.0	8	6	3	50	33	37	8	22	A-4b
		20.0-23.0	3	3	3	34	57	37	12	15	A-6a
		23.0-26.5	8	5	3	34	50	38	11	13	A-6a
		26.5-29.0	Brown Weathered Shale							13	Visual

DRIVE SAMPLE SOIL TEST DATA

Station	Offset	Depth From-To	% Agg.	% C.S.	% F.S.	% Silt	% Clay	L.L.	P.I.	% W.C.	SHTL Class.
103+00	130'Lt	5.0-6.0	40	8	3	24	16	30	8	9	A-4a
		10.0-11.0	41	10	5	23	21	31	11	11	A-6a
		15.0-16.0	3	5	6	43	43	32	11	17	A-6a
		20.0-21.0	13	9	5	39	34	31	11	19	A-6a
		25.0-26.0	20	6	8	31	35	30	11	15	A-6a
		30.0-31.0	2	5	7	39	47	31	11	21	A-6a
		35.0-36.0	2	6	3	55	34	30	7	19	A-4b
104+00	149'Lt	5.0-6.0	39	8	5	23	25	36	11	15	A-6a
		10.0-11.0	39	9	5	24	23	29	11	18	A-6a
		15.0-16.0	26	5	4	37	28	28	11	17	A-6a
		20.0-21.0	16	4	2	42	36	33	11	15	A-6a
		25.0-26.0	7	7	6	15	65	32	11	18	A-6a
		30.0-31.0	5	9	10	36	40	29	11	17	A-6a
		35.0-36.0	3	5	7	37	48	32	11	18	A-6a
		40.0-41.0	0	3	6	44	47	34	13	19	A-6a
		45.0-46.0	18	5	4	37	36	32	11	18	A-6a
		50.0-51.0	11	6	4	37	42	35	11	26	A-6a
105+50	140'Lt	5.0-6.0	56	11	5	14	15	28	6	15	A-2-4
		10.0-11.0	40	3	2	25	30	33	11	15	A-6a
		15.0-16.0	8	3	4	42	43	32	11	17	A-6a
		20.0-21.0	49	8	6	18	19	28	9	12	A-4a
		25.0-26.0	2	5	8	37	48	32	11	16	A-6a
		30.0-31.0	4	5	8	39	44	30	11	16	A-6a
		35.0-36.0	27	9	8	24	32	34	14	12	A-6a
		40.0-41.0	4	5	8	40	43	36	13	17	A-6a
		45.0-46.0	14	5	6	37	38	31	11	13	A-6a
		50.0-51.0	5	6	3	50	36	28	8	14	A-4b
		55.0-56.0	7	7	11	34	41	30	11	15	A-6a
		60.0-61.0	0	1	1	54	44	34	8	27	A-4b
		65.0-66.0	0	3	2	44	51	44	15	20	A-7-6
107+00	140'Lt	5.0-6.0	40	6	4	27	23	31	11	12	A-6a
		10.0-11.0	4	3	6	42	45	31	12	15	A-6a
		15.0-16.0	56	1	6	17	18	29	10	21	A-2-4
		20.0-21.0	7	4	7	42	40	32	11	16	A-6a
		25.0-26.0	6	5	8	40	41	31	11	16	A-6a
		30.0-31.0	4	4	7	44	41	30	11	15	A-6a
		35.0-36.0	42	8	6	24	20	28	8	19	A-4a
		40.0-41.0	6	4	8	40	42	29	11	18	A-6a
		45.0-46.0	18	4	7	29	42	33	11	19	A-6a
		50.0-51.0	2	2	6	44	46	31	11	17	A-6a
		55.0-56.0	4	7	9	40	40	28	11	16	A-6a
		60.0-61.0	10	11	9	35	35	36	11	23	A-6a
		65.0-66.0	18	8	17	35	22	23	4	22	A-4a

EMB. FAILURE INVESTIGATION
CUYAHOGA - LAKE COS.
CUY-1-15.91
LAK-1-0.00
OHIO STATE HIGHWAY TESTING LABORATORY
COLUMBUS, OHIO

2/6

SUMMARY OF SOIL TEST DATA

NOTE: NP shown in Liquid Limit and Plasticity Index columns indicates that the material is non-plastic.

Station	Offset	Depth From-To	% Agg.	% C.S.	% F.S.	% Silt	% Clay	L.L.	P.I.	% W.C.	SHTL Class.
101+50	230'Lt	0.0-3.5	22	10	11	30	27	37	7	17	A-4a
		3.5-5.0	Light Brown Weathered Shale							10	Visual
		5.0-8.0	Light Brown Weathered Shale							7	Visual
		8.0-12.0	Gray Weathered Shale							14	Visual
101+50	150'Lt	0.0-3.5	15	6	4	44	31	27	11	10	A-6a
		3.5-6.0	38	16	8	13	25	27	7	9	A-4a
		6.0-9.0	Gray Weathered Shale							6	Visual
		9.0-11.0	Brown Weathered Shale							11	Visual
		11.0-13.0	Gray Weathered Shale							7	Visual
101+50	70'Lt	0.0-2.0	23	4	6	40	27	31	11	11	A-6a
		2.0-6.5	Brown Weathered Shale							9	Visual
		6.5-8.5	Gray Weathered Shale							8	Visual
102+00	400'Lt	0.3-4.0	0	3	5	48	44	37	11	25	A-6a
		4.0-9.0	0	3	4	40	53	37	14	32	A-6a
		9.0-16.0	0	1	0	67	32	NP	NP	32	A-4b
		16.0-20.0	24	3	1	36	36	33	11	15	A-6a
		20.0-22.0	Gray Broken Shale							12	Visual
102+00	350'Lt	0.3-4.0	15	8	6	40	31	32	11	13	A-6a
		4.0-10.0	8	4	6	44	38	32	12	15	A-6a
		10.0-13.0	2	3	4	50	41	29	6	20	A-4b
		13.0-15.0	Gray Broken Shale							8	Visual
102+00	300'Lt	0.3-4.0	14	8	6	32	40	33	11	12	A-6a
		4.0-7.0	10	14	7	27	42	33	13	17	A-6a
		7.0-12.0	Brown Weathered Shale							9	Visual
		12.0-16.0	Gray Weathered Shale							7	Visual
		16.0-18.0	Gray Weathered Shale							15	Visual
		18.0-20.0	Gray Broken Shale							7	Visual
102+00	250'Lt	0.2-3.0	25	3	2	34	36	36	11	14	A-6a
		3.0-10.0	51	3	2	24	20	33	11	9	A-6a
		10.0-13.0	Gray Broken Shale							6	Visual
102+00	200'Lt	0.0-5.0	Brown Sandy Silty Clay & Soft Shale Fragments							10	Visual
		5.0-7.0	Gray Broken Shale							5	Visual
102+00	145'Lt	0.0-5.5	Gray Silty Clay and Shale fragments							8	Visual
		5.5-11.0	29	5	3	23	40	34	11	8	A-6a
		11.0-13.5	16	8	7	38	31	32	11	10	A-6a
		13.5-15.0	Gray Weathered Shale							4	Visual
102+00	70'Lt	0.0-4.0	Brown Silty Clay and Shale fragments							7	Visual
		4.0-6.0	Brown Silty Clay and Shale fragments							11	Visual
		6.0-7.0	23	3	2	33	39	32	11	12	A-6a
		7.0-11.0	Brown Weathered Shale							8	Visual
103+00	250'Lt	0.0-7.0	Rock Soil Mixture							15	Visual
		7.0-11.0	Rock Soil Mixture							4	Visual
		11.0-16.0	45	3	2	26	24	37	13	11	A-6a
		16.0-19.0	4	4	4	42	46	31	11	16	A-6a
		19.0-26.0	14	2	4	46	34	35	13	16	A-6a
		26.0-28.0	Gray Broken Shale							8	Visual
103+00	208'Lt	0.0-5.0	22	10	10	36	22	28	7	13	A-4a
		5.0-10.0	5	5	9	43	38	29	11	13	A-6a
		10.0-15.0	9	8	7	38	38	31	11	16	A-6a
		15.0-19.0	7	7	5	56	25	34	8	22	A-4b
		19.0-26.0	8	3	4	37	48	32	11	16	A-6a
		26.0-32.0	Brown Weathered Shale							11	Visual
103+00	177'Lt	0.0-6.0	22	7	6	49	16	31	8	11	A-4a
		6.0-12.0	16	5	5	39	34	30	11	13	A-6a
		12.0-17.0	7	7	10	47	29	29	13	17	A-6a
		17.0-21.0	4	6	8	45	37	27	11	11	A-6a
		21.0-26.0	7	8	4	43	38	34	11	20	A-6a
		26.0-30.0	Brown Weathered Shale							11	Visual
103+00	70'Lt	0.0-5.0	Rock Soil Mixture							8	Visual
		5.0-8.0	Rock Soil Mixture							10	Visual
		8.0-12.0	6	3	7	44	40	39	11	13	A-6a
		12.0-16.5	22	4	2	32	40	37	11	13	A-6a
		16.5-20.0	Gray Broken Shale							7	Visual
104+00	400'Lt	0.3-4.0	36	11	6	21	26	32	7	9	A-4a
		4.0-8.0	0	0	1	42	47	38	13	27	A-6a
		8.0-15.0	0	0	0	57	43	NP	NP	31	A-4b
		15.0-20.0	5	7	3	51	34	26	4	31	A-4b
		20.0-23.0	31	41	14	- 14 -		NP	NP	14	A-1-b
		23.0-27.0	36	15	5	24	20	29	10	13	A-4a
104+00	350'Lt	0.3-4.0	0	3	6	41	50	33	11	15	A-6a
		4.0-11.0	0	1	1	39	59	36	12	26	A-6a
		11.0-17.0	0	0	0	52	48	28	4	37	A-4b
		17.0-21.0	9	38	21	18	14	19	3	16	A-3a
		21.0-23.0	24	5	6	37	28	26	11	13	A-6a
104+00	286'Lt	0.0-4.0	35	15	7	22	21	31	4	18	A-4a
		4.0-8.0	7	8	21	41	23	NP	NP	20	A-4a
		8.0-12.0	4	2	2	42	50	37	11	18	A-6a
104+00	216'Lt	0.0-5.0	5	6	11	38	40	30	11	14	A-6a
		5.0-10.0	4	6	10	38	42	30	11	13	A-6a
		10.0-15.0	5	8	9	38	39	29	11	14	A-6a
		15.0-20.0	6	9	11	40	34	29	11	15	A-6a
		20.0-27.0	12	8	7	36	37	29	11	16	A-6a
		27.0-32.0	11	6	5	39	39	34	11	22	A-6a
104+00	70'Lt	0.0-2.0	Rock Soil Mixture							6	Visual
		2.0-6.5	Rock Soil Mixture							9	Visual
		6.5-8.5	Rock Soil Mixture							11	Visual
		8.5-13.0	Rock Soil Mixture							9	Visual
		13.0-17.0	24	6	7	34	29	28	7	12	A-4a
		17.0-22.0	15	4	5	36	40	36	12	16	A-6a
		22.0-27.0	4	4	6	45	44	33	11	15	A-6a
		27.0-32.0	6	7	10	37	40	29	11	15	A-6a
104+00	25'Lt	0.0-5.0	Rock Soil Mixture							10	Visual
		5.0-7.5	26	5	4	33	32	36	11	17	A-6a
		7.5-12.0	16	8	6	40	30	39	12	21	A-6a
		12.0-15.5	32	4	3	30	31	36	11	13	A-6a
		15.5-17.5	Brown Silty Clay & Shale Fragments							8	Visual
		17.5-19.5	Gray Broken Shale							8	Visual
105+00	300'Lt	0.0-7.0	16	15	12	31	26	28	5	13	A-4a
		7.0-10.0	0	2	8	66	24	NP	NP	25	A-4b
		10.0-13.0	5	20	42	21	12	NP	NP	13	A-3a
		13.0-17.0	Gray Broken Shale							10	Visual
105+10	70'Lt	0.0-5.0	Rock Soil Mixture							11	Visual
		5.0-10.0	Rock Soil Mixture							9	Visual
		10.0-11.5	Rock Soil Mixture							13	Visual
		11.5-16.0	5	5	6	34	49	34	11	15	A-6a
		16.0-21.0	9	4	7	37	43	36	11	19	A-6a
		21.0-26.0	11	5	9	34	41	34	11	17	A-6a
		26.0-30.0	5	6	7	41	41	33	11	16	A-6a
		30.0-32.0	28	5	8	30	29	31	11	12	A-6a
105+10	50'Lt	0.0-5.5	Rock Soil Mixture							8	Visual
		5.5-11.0	10	4	5	37	44	35	11	15	A-6a
		11.0-16.0	16	6	9	36	33	34	11	16	A-6a
		16.0-21.0	9	5	4	35	47	32	11	14	A-6a
		21.0-26.0	18	8	9	26	39	30	11	19	A-6a
		26.0-32.0	7	5	9	37	42	31	11	14	A-6a
105+10	100'Rt	0.0-6.0	Gray Weathered Shale							8	Visual
105+50 (105+50)	400'Lt	0.0-5.0	15	13	9	35	28	31	9	17	A-4a
		5.0-8.0	0	2	10	45	43	29	11	36	A-6a
		8.0-15.0	17	53	22	- 8 -		NP	NP	17	A-1-b
		15.0-21.0	31	47	17	- 5 -		NP	NP	17	A-1-b
		21.0-23.0	36	18	6	20	20	26	2	13	A-4a
105+50 (105+50)	350'Lt	0.3-5.0	6	3	3	47	41	31	11	14	A-6a
		5.0-10.0	0	1	0	55	44	30	6	34	A-4b
		10.0-12.0	45	27	8	11	9	NP	NP	10	A-1-b
		12.0-15.0	29	13	10	28	20	26	4	22	A-4a
		15.0-17.0	38	14	6	25	17	28	6	15	A-4a
105+60	300'Lt	0.0-4.0	0	1	1	53	45	36	8	28	A-4b
		4.0-10.0	0	1	2	47	50	32	11	33	A-6a
		10.0-16.0	0	1	2	56	41	NP	NP	30	A-4b
		16.0-17.0	12	9	11	45	23	26	6	12	A-4a
105+60	250'Lt	0.0-5.0	4	5	8	38	45	30	11	17	A-6a
		5.0-10.0	4	4	8	34	50	31	11	17	A-6a
		10.0-15.0	6	9	11	33	41	27	11	16	A-6a
		15.0-20.0	12	7	8	39	34	31	11	14	A-6a
		20.0-23.0	7	8	11	37	37	27	7	17	A-4a
		23.0-29.0	13	8	6	37	36	36	14	18	A-6a
		29.0-32.0	Gray Broken Shale							8	Visual
105+60	10'Lt	0.0-4.0	23	4	3	32	38	34	14	11	A-6a
		4.0-9.0	21	9	9	26	35	36	14	13	A-6a
		9.0-14.0	5	5	7	31	52	36	13	16	A-6a
		14.0-19.0	5	6	9	39	41	30	11	15	A-6a
		19.0-20.5	5	6	9	37	43	30	11	16	A-6a
		20.5-23.0	14	7	8	33	38	32	11	14	A-6a
		23.0-26.5	3	3	4	45	45	42	13	23	A-7-6
		26.5-31.0	Brown Weathered Shale							11	Visual
105+50	15'Rt	0.0-4.0	14	5	5	36	40	31	11	9	A-6a
		4.0-9.0	9	5	7	35	44	34	11	16	A-6a
		9.0-12.0	23	5	6	33	33	30	11	12	A-6a
		12.0-16.0	11	7	6	39	37	39	15	17	A-6a
		16.0-20.0	15	9	7	35	34	31	11	13	A-6a
		20.0-25.0	Brown Weathered Shale							10	Visual
105+50	50'Rt	0.0-2.0	54	5	6	19	16	31	6	10	A-2-4
		2.0-7.0	15	4	3	30	48	48	17	19	A-7-6
		7.0-10.0	20	6	3	39	32	34	11	13	A-6a
		10.0-13.0	Brown Weathered Shale							10	Visual
105+60	100'Rt	0.0-2.5	27	3	4	31	35	38	11	11	A-6a
		2.5-7.0	Gray Weathered Shale							5	Visual
		7.0-11.0	Gray Weathered Shale							4	Visual
106+00	300'Lt	0.0-6.0	10	28	12	31	19	33	8	18	A-4a
		6.0-8.0	47	15	7	17	14	28	4	15	A-2-4
		8.0-14.0	45	30	9	8	8	22	5	15	A-1-b
		14.0-16.0	31	3	6	40	20	27	4	10	A-4a
106+00	250'Lt	0.0-5.0	7	6	9	42	36	36	14	14	A-6a
		5.0-10.0	5	7	10	38	40	29	11	14	A-6a
		10.0-15.0	8	10	12	38	32	26	6	16	A-4a
		15.0-20.0	14	6	11	31	38	35	15	15	A-6a
		20.0-27.0	11	10	8	32	39	37	11	24	A-6a
		27.0-30.0	0	0	2	76	22	NP	NP	26	A-4b
		30.0-32.0	Gray Silty Clay & Soft Shale Fragments							10	Visual
106+00	10'Lt	0.0-5.0	11	6	6	31	44	37	11	15	A-6a
		5.0-10.0	7	3	7	38	45	31	11	15	A-6a
		10.0-15.0	8	5	8	41	38	36	13	16	A-6a
		15.0-20.0	6	6	8	41	39	32	11	15	A-6a
		20.0-21.0	13	6	5	42	34	34	11	15	A-6a
		21.0-26.0	5	6	7	38	44	32	11	16	A-6a
		26.0-28.0	5	6	10	40	40	34	11	17	A-6a
		28.0-30.0	17	7	6	37	33	41	14	17	A-7-6
		30.0-32.0	6	4	4	42	44	37	11	24	A-6a
106+00	13'Rt	0.0-5.0	8	2	5	37	48	38	14	16	A-6a
		5.0-10.0	13	8	9	40	30	29	11	15	A-6a
		10.0-15.0	6	5	8	47	34	31	11	14	A-6a
		15.0-17.5	3	7	11	43	36	27	6	15	A-4a
		17.5-21.0	20	9	8	34	29	31	11	14	A-6a
		21.0-24.0	6	3	3	40	48	40	12	19	A-6a
		24.0-28.0	17	6	4	31	42	36	11	13	A-6a
		28.0-31.0	21	5	5	34	35	35	11	16	A-6a
		31.0-32.0	33	5	6	28	28	33	11	15	A-6a
106+00	50'Rt	0.0-1.5	19	4	3	50	24	32	4	13	A-4b
		1.5-5.0	2	3	17	37	41	29	11	18	A-6a
		5.0-7.0	21	5	5	43	26	33	11	12	A-6a
		7.0-12.0	13	7	6	40	34	30	11	13	A-6a
		12.0-17.0	2	4	2	51	41	41	15	17	A-7-6
		17.0-22.0	17	6	3	41	33	36	11	13	A-6a
		22.0-26.0	Brown Weathered Shale							10	Visual
106+30	416'Lt	0.5-6.0	16	15	12	29	28	31	7	27	A-4a
		6.0-10.0	0	0	0	57	43	33	5	39	A-4b
		10.0-16.0	47	40	9	- 4 -		NP	NP	15	A-1-b
		16.0-22.0	67	23	4	- 6 -		NP	NP	10	A-1-b
		22.0-24.0	25	8	7	30	30	27	11	10	A-6a
107+00	300'Lt	0.0-4.0	2	14	6	47	31	34	5	29	A-4a
		4.0-6.0	0	1	5	70	24	NP	NP	30	A-4b
		6.0-12.0	44	42	8	- 6 -		NP	NP	17	A-1-b
		12.0-17.0	40	50	7	- 3 -		NP	NP	14	A-1-b
107+00	250'Lt	0.0-3.0	Rock Soil Mixture							9	Visual
		3.0-10.0	4	4	6	38	48	29	11	17	A-6a
		10.0-13.0	9	5	10	38	38	28	11	12	A-6a
		13.0-20.0	11	6	10	38	35	30	11	15	A-6a
107+00	150'Rt	0.0-5.0	Rock Soil Mixture							7	Visual
		5.0-8.0	Rock Soil Mixture							5	Visual
		8.0-12.0	Rock Soil Mixture							15	Visual
		12.0-15.0	Rock Soil Mixture							14	Visual
		15.0-16.0	Rock Soil Mixture							10	Visual
108+00	300'Lt	0.0-5.0	28	12	10	32	18	NP	NP	19	A-4a
		5.0-7.0	60	3	6	19	12	33	9	16	A-2-4
		7.0-14.0	56	30	6	- 9 -		NP	NP	12	A-1-a
		14.0-16.0	39	8	4	28	21	28	9	15	A-4a
108+00	135'Lt	0.0-5.0	Rock Soil Mixture							8	Visual
		5.0-9.5	Rock Soil Mixture							7	Visual
		9.5-11.5	0	3	7	54	36	37	13	17	A-6a
		11.5-16.0	8	2	6	42	42	28	11	16	A-6a
		16.0-21.0	7	3	4	45	41	24	11	14	A-6a
		21.0-26.0	16	9	6	34	35	32	11	13	A-6a
		26.0-30.0	6	5	9	44	36	34	12	17	A-6a
108+00	140'Rt	0.0-2.5	Rock Soil Mixture							8	Visual
		2.5-8.0	Rock Soil Mixture							12	Visual
		8.0-13.0	Rock Soil Mixture							15	Visual
		13.0-15.0	Rock Soil Mixture							8 (22)	Visual
		15.0-20.0	8	6	3	50	33	37	8	22	A-4b (-4b)
		20.0-23.0	3	3	3	34	57	37	12	15	A-6a
		23.0-26.5	8	5	3	34	50	38	11	13	A-6a
		26.5-29.0	Brown Weathered Shale							13	Visual

DRIVE SAMPLE SOIL TEST DATA

Station	Offset	Depth From-To	% Agg.	% C.S.	% F.S.	% Silt	% Clay	L.L.	P.I.	% W.C.	SHTL Class.
103+00	130'Lt	5.0-6.0	49	8	3	24	16	30	8	9	A-4a
		10.0-11.0	41	10	5	23	21	31	11	11	A-6a
		15.0-16.0	3	5	6	43	43	32	11	17	A-6a
		20.0-21.0	13	9	5	39	34	31	11	19	A-6a
		25.0-26.0	20	6	8	31	35	30	11	15	A-6a
		30.0-31.0	2	5	7	39	47	31	11	21	A-6a
		35.0-36.0	2	6	3	55	34	30	7	19	A-4b
104+00	149'Lt	5.0-6.0	39	8	5	23	25	36	11	15	A-6a
		10.0-11.0	39	9	5	24	23	29	11	18	A-6a
		15.0-16.0	26	5	4	37	28	28	11	17	A-6a
		20.0-21.0	16	4	2	42	36	33	11	15	A-6a
		25.0-26.0	7	7	6	15	65	32	11	18	A-6a
		30.0-31.0	5	9	10	36	40	29	11	17	A-6a
		35.0-36.0	3	5	7	37	48	32	11	18	A-6a
		40.0-41.0	0	3	6	44	47	34	13	19	A-6a
		45.0-46.0	18	5	4	37	36	32	11	18	A-6a
		50.0-51.0	11	6	4	37	42	35	11	26	A-6a
106+50	140'Lt	5.0-6.0	55	11	5	14	15	28	6	15	A-2-4
		10.0-11.0	40	3	2	25	30	33	11	15	A-6a
		15.0-16.0	8	3	4	42	43	32	11	17	A-6a
		20.0-21.0	49	8	6	18	19	28	9	12	A-4a
		25.0-26.0	2	5	8	37	48	32	11	16	A-6a
		30.0-31.0	4	5	8	39	44	30	11	16	A-6a
		35.0-36.0	27	9	8	24	32	34	14	12	A-6a
		40.0-41.0	4	5	8	40	43	36	13	17	A-6a
		45.0-46.0	14	5	6	37	38	31	11	13	A-6a
		50.0-51.0	5	6	3	50	36	28	8	14	A-4b
		55.0-56.0	7	7	11	34	41	30	11	15	A-6a
		60.0-61.0	0	1	1	54	44	34	8	27	A-4b
		65.0-66.0	0	3	2	44	51	44	15	20	A-7-6
107+00	140'Lt	5.0-6.0	40	6	4	27	23	31	11	12	A-6a
		10.0-11.0	4	3	6	42	45	31	12	15	A-6a
		15.0-16.0	56	1	6	17	18	29	10	21	A-2-4
		20.0-21.0	7	4	7	42	40	32	11	16	A-6a
		25.0-26.0	6	5	8	40	41	31	11	16	A-6a
		30.0-31.0	4	4	7	44	41	30	11	15	A-6a
		35.0-36.0	42	8	6	24	20	28	8	19	A-4a
		40.0-41.0	6	4	8	40	42	29	11	18	A-6a
		45.0-46.0	18	4	7	29	42	33	11	19	A-6a
		50.0-51.0	2	2	6	44	46	31	11	17	A-6a
		55.0-56.0	4	7	9	40	40	28	11	16	A-6a
		60.0-61.0	10	11	9	35	35	36	11	23	A-6a
		65.0-66.0	18	8	17	35	22	23	4	22	A-4a

EMB. FAILURE INVESTIGATION
CUYAHOGA - LAKE COS.
CUY - 1 - 15.91
LAK - 1 - 0.00
OHIO STATE HIGHWAY
TESTING LABORATORY
COLUMBUS, OHIO

3/6

Cross Section
Sta. 102+00

Original ground line
Plan section

Existing ground line
Break
Brown Sandy Silty Clay and Soft Shale Fragments
Gray Silty Clay and Shale Fragments
Brown Silty Clay and Shale Fragments
Brown Silty Clay and Shale Fragments
Refusal

Cross Section
Sta. 101+40

Original ground line
Plan section

Existing ground line
(Sta. 101+50)
Refusal

780 760 740 720 700 680 790

400 380 360 340 320 300 280 260 240 220 200 180 160 140 120 100 80 60 40 20 0 20 40 60 80 100 120 140 160 180 200

EMB. FAILURE INVESTIGATION
CUYAHOGA - LAKE COS.
CUY - 1 - 15.91
LAK - 1 - 0.00
OHIO STATE HIGHWAY
TESTING LABORATORY
COLUMBUS, OHIO

3/6

Cross Section
Sta. 102+00

Original ground line
Plan section

Existing ground line
Break
Brown Sandy Silty Clay and Soft Shale Fragments
Gray Silty Clay and Shale Fragments
Brown Silty Clay and Shale Fragments
Brown Silty Clay and Shale Fragments
Refusal

Cross Section
Sta. 101+40

Original ground line
Plan section

Existing ground line
(Sta. 101+50)
Refusal

780 760 740 720 700 680 790

400 380 360 340 320 300 280 260 240 220 200 180 160 140 120 100 80 60 40 20 0 20 40 60 80 100 120 140 160 180 200

EMB. FAILURE INVESTIGATION
CUYAHOGA - LAKE COS.
CUY - 1 - 15.91
LAK - 1 - 0.00
OHIO STATE HIGHWAY
TESTING LABORATORY
COLUMBUS, OHIO

4
6

Cross Section Sta. 104+00

Existing ground line

Break

Original ground line

Plan section

Brown Silty Clay and Shale Fragments

Trace of Organic

Trace of Organic

Trace of Organic

Top of Rock-In-Place.
Shale, gray, argillaceous, micaceous and siliceous from elev. 702.3' to 701.3', fissile, hard, broken, badly broken from elev. 701.3' to 700.3'. Core loss 14%.

Refusal

Cross Section Sta. 103+00

Existing ground line

Break

Original ground line

Plan section

Top of Rock-In-Place.
Shale, gray, argillaceous, fissile, hard, broken. Core loss 2.5%.

Refusal

780 760 740 720 700 680 660

400 380 360 340 320 300 280 260 240 220 200 180 160 140 120 100 80 60 40 20 ℄ 20 40 60 80 100 120 140 160 180 200

EMB. FAILURE INVESTIGATION
CUYAHOGA - LAKE COS.
CUY-1-15.91
LAK-1-0.00
OHIO STATE HIGHWAY
TESTING LABORATORY
COLUMBUS, OHIO

5
6

Cross Section
Sta. 106+00

Existing ground line
Break
Plan section
Original ground line
Existing ground line
Refusal
Gray Silty Clay and Soft Shale Fragments
Refusal

Cross Section
Sta. 105+50

Existing ground line
Break
Plan section
(Sta. 105+40)
(Sta. 105+10)
(Sta. 105+10)
Original ground line
Top of Rock-In-Place
Shale, gray, argillaceous, firm, broken.
Core loss 0%.
Refusal
Refusal
Refusal
Refusal
Refusal
Refusal
Organic
Trace of Organic
(Sta. 105+00)
13+03'

780
760
740
720
700
680
660

400 380 360 340 320 300 280 260 240 220 200 180 160 140 120 100 80 60 40 20 0 20 40 60 80 100 120 140 160 180 200

EMB. FAILURE INVESTIGATION
CUYAHOGA - LAKE COS.
CUY-1-15.91
LAK-1-0.00
OHIO STATE HIGHWAY
TESTING LABORATORY
COLUMBUS, OHIO

6/6

Cross Section
Sta. 108+00

Cross Section
Sta. 107+00

Existing ground line
Original ground line
Plan section
Refusal
Refusal (Boulders)
Trace of organic
Slightly organic
Top of Rock-In-Place
Shale, gray, argillaceous, soft to firm, broken. Core loss 3%.

780
760
740
720
700
680
660

420 400 380 360 340 320 300 280 260 240 220 200 180 160 140 120 100 80 60 40 20 ℄ 20 40 60 80 100 120 140 160 180 200

C-2 HISTORIC SITE PHOTOS FROM TIMS

Photo C-2.1: General View of The Site obtained from ODOT TIMS Website

Photo C-2.2: View of the Toe of Slope showing Erosion, obtained from ODOT TIMS Website

Photo C-2.3: View of the Toe of Slope Showing Erosion and Scarp, obtained from ODOT TIMS Website